THE

POPULAR SCIENCE MONTHLY.

FEBRUARY, 1889.

NEW CHAPTERS IN THE WARFARE OF SCIENCE.

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"DEMONIACAL POSSESSION" AND INSANITY.

PART I.

OF all the triumphs won by science for humanity, none has been farther-reaching in its good effects than the modern treatment of the insane. But it is the result of a struggle long and severe between two great forces. On one side have stood the survivals of various superstitions, the metaphysics of various philosophies, the theologies of various religions, the literal interpretation of various sacred books, and especially of our own—all compacted into a creed that insanity is mainly or largely demoniacal possession; on the other side has stood science, gradually accumulating proofs that insanity is always the result of physical disease.

I purpose, in this chapter and the following, to sketch, as briefly as I may, the history of this warfare, or rather of this evolution of truth out of error.

Nothing is more simple and natural, in the early stages of civilization, than belief in occult, self-conscious powers of evil. Troubles and calamities come upon man; his ignorance of physical laws forbids him to attribute them to physical causes; he therefore attributes them sometimes to the wrath of a good being, but more frequently to the malice of an evil being.

Especially is this the case with diseases. The real causes of disease are so intricate that they are reached only after ages of scientific labor; hence they, above all, have been attributed to the influence of evil spirits.*

* On the general attribution of disease to demoniacal influence, see Sprenger, "History of Medicine," *passim* (note, for a later attitude, ii, 150–170, 178); Calmeil, "De la Folie,"

But, if ordinary diseases were likely to be attributed to diabolical agency, how much more diseases of the brain, and especially the more obscure of these! These, indeed, seemed to the vast majority of mankind possible only on the theory of satanic intervention. Any approach to a true theory of the connection between physical causes and mental results is one of the highest acquisitions of science.

Here and there, during the whole historic period, keen men had obtained an inkling of the truth; but, to the vast multitude, down to the end of the seventeenth century, nothing was more clear than that insanity is in many, if not in most, cases demoniacal possession.

Yet at a very early date, in Greece and Rome, science asserted itself, and a beginning was made which seemed destined to bring a large fruitage of blessings.* In the fifth century before the Christian era, Hippocrates of Cos asserted the great truth that all madness is simply disease of the brain, thereby beginning a noble development of truth and mercy which lasted nearly a thousand years. In the first century after Christ, Aretæus carried these ideas yet further, observed the phenomena of insanity with great acuteness, and reached yet more valuable results. Near the beginning of the following century, Soranus went still further in the same path, giving new results of research, and strengthening scientific truth. Toward the end of the same century, a new epoch was ushered in by Galen, under whom the same truth was developed yet further, and the path toward merciful treatment of the insane made yet more clear. In the third century came Celius Aurelianus, who received this deposit of precious truth, elaborated it, and brought forth the great idea which, had theology, citing Biblical texts, not banished it, would

Paris, 1845, i, 104, 105; Esquirol, "Des Maladies Mentales," Paris, 1838, i, 482; also Tylor, "Primitive Culture." For a very plain and honest statement of this view in our own sacred books, see Oort, Hooykaas, and Kuenen, "The Bible for Young People," English translation, v, 167, and following; also Farrar's "Life of Christ," chap. xvii. For this idea in Greece and elsewhere, see Maury, "La Magie," etc., iii, 276, giving, among other citations, one from book v of the "Odyssey." On the influence of Platonism, see Esquirol and others, as above—the main passage cited is from the "Phædo." For the devotion of the early fathers and doctors to this idea, see citations from Eusebius, Lactantius, St. Jerome, St. Augustine, St. John Chrysostom, St. Gregory Nazianzen, in Tissot, "L'Imagination," p. 369; also Jacob (i. e., Paul Lacroix), "Croyances Populaires," p. 183. For St. Augustine, see also his "De Civitate Dei," lib. 22, cap. viii, and his "Enarratio in Psal.," cxxxv, 1. For the breaking away of the religious orders in Italy from the entire supremacy of this idea, see Becavin, "L'École de Salerne," Paris, 1888; also Daremberg, "Histoire de la Médecine." Even so late as the Protestant Reformation, Martin Luther maintained ("Table-Talk," Hazlitt's translation, London, 1872, pp. 250–256) that "Satan produces all the maladies which afflict mankind."

* It is significant of this scientific attitude that the Greek word for superstition signifies, literally, fear of gods or demons.

have saved fifteen centuries of cruelty—a truth not fully recognized again till near the beginning of the present century—the truth that insanity is brain-disease, and that the treatment of it must be gentle and kind. In the sixth century Alexander of Tralles presented still more fruitful researches, and taught the world how to deal with *melancholia*; and, finally, in the seventh century, this great line of scientific men, working mainly under pagan auspices, was closed by Paul of Ægina, who, under the protection of Caliph Omar, made still further observations and additions to truth, but, above all, laid stress on the cure of madness as a disease, and on the absolute necessity of mild treatment.

Such was this great succession in the apostolate of truth; evidently no other has ever shown itself more directly under divine grace, illumination, and guidance. It had given to the world what might have been one of its greatest blessings.*

But, most unfortunately, there set into the early Church a current of belief which was destined to bring all these noble acquisitions of science and religion to naught, and, during centuries, to inflict tortures, physical and mental, upon hundreds of thousands of innocent men and women—a belief which held its cruel sway for nearly eighteen centuries; and this belief was that madness was mainly or largely possession by the Devil.

This idea of diabolic agency in mental disease grew luxuriantly in all the Oriental sacred literatures, and especially in that of the Jews. Such cases in the Old Testament as the evil spirit in Saul, which we now see to have been simply melancholy, and in the New Testament the various accounts of the casting out of devils, through which is refracted the beautiful and simple story of that power by which Jesus of Nazareth soothed perturbed minds by his presence or quelled outbursts of madness by his word, give abundant examples of this. In Greece, too, an idea akin to this found lodgment both in the popular belief and in the philosophy of Plato and Socrates;† and though, as we have seen, the great leaders in medical science had taught with more or less distinctness that insanity is the result of physical disease, there was a

* For authorities regarding this development of scientific truth and mercy in antiquity, see especially Kraft-Ebing, "Lehrbuch der Psychiatrie," Stuttgart, 1888, p. 40 and the pages following; Trélat, "Recherches Historiques sur la Folie," Paris, 1839; Semelaigne, "L'Aliénation mentale dans l'Antiquité," Paris, 1869; Dagron, "Des Aliénés," Paris, 1875; also Calmeil, "De la Folie," Sprenger, and especially Isensée, "Geschichte der Medicin," Berlin, 1840.

† It is, indeed, extremely doubtful whether Plato himself or his contemporaries knew anything of *evil* demons, this conception probably coming into the Greek world, as into the Latin, with the Oriental influences that began to prevail about the time of the birth of Christ; but to the early Christians a demon was a demon, and Plato's, good or bad, were pagan, and therefore devils.

strong popular tendency to attribute the more troublesome cases of it to hostile spiritual influence.*

From all these sources, but especially from our sacred books and the writings of Plato, this theory that mental disease is caused largely or mainly by satanic influence passed into the early Church. In the apostolic times no belief seems to have been more firmly settled. The early Fathers and Doctors in the following age universally accepted it, and the apologists generally spoke of the power of casting out devils as a leading proof of the divine origin of the Christian religion.†

As a result of this idea, the Christian Church at an early period in its existence virtually gave up the noble conquests of Greek and Roman science in this field, and originated a regular discipline for persons supposed to be possessed, based, as was believed, upon Scriptural theology. But, during the centuries before theology and ecclesiasticism were largely developed, this discipline was, as a rule, gentle and useful. The afflicted, when not too violent, were generally admitted to the exercises of public worship, and a kindly system of cure was attempted, in which prominence was given to holy water, sanctified ointments, the breath or spittle of the priest, the touching of relics, visits to holy places, and submission to mild forms of exorcism. There can be no doubt that many of these things, when judiciously used, in that spirit of love and gentleness and devotion inherited by the earlier disciples from "the Master," produced good effects in soothing disturbed minds and aiding their cure.

Among the thousands of fetiches of various sorts then resorted to may be named, as typical, the Holy Handkerchief of Besançon. During many centuries multitudes came from far and near to be touched by it; for, it was argued, if touching the garments of St. Paul, at Ephesus, had cured the diseased, how much more might be expected of a handkerchief of the Lord himself!

With ideas of this sort was mingled a vague belief in medical

* The Greek word "epilepsy" is itself a survival of the old belief, fossilized in a word, since its literal meaning refers to the *seizure* of the patient by evil spirits.

† For a striking statement of the Jewish belief in diabolical interference, see Josephus, "De Bello Judaico," vii, 6, iii; also his "Antiquities," viii, Whiston's translation. On the "devil cast out," in Mark ix, 17–29, as an undoubted case of epilepsy, see Cherullier, "Essai sur l'Épilepsie"; also Maury, art. "Démoniaque" in the "Encyclopédie Moderne." In one text, at least, the popular belief is perfectly shown as confounding madness and possession: "He hath a devil and is mad," John x, 20. Among the multitude of texts those most relied upon were Matthew viii, 28, and Luke x, 17; and, for the use of fetiches in driving out evil spirits, the account of the cures wrought by touching the garments of St. Paul in Acts xix, 12. On the general subject see authorities already given, and as a typical passage Tertullian, "ad. Scap.," ii; for the very gross view taken by St. Basil, see Cudworth, "Intellectual System," ii, 648; also Archdeacon Farrar's "Life of Christ." For a curious presentation of Greek views, see Lélut, "Le Démon de Socrate," Paris, 1836; and, for the transmission of these to Christianity, see same, p. 201, and following.

treatment, and out of this mixture were evolved such prescriptions as the following:

"If an elf or a goblin come, smear his forehead with this salve, put it on his eyes, cense him with incense, and sign him frequently with the sign of the cross."

"For a fiend-sick man: When a devil possesses a man, or controls him from within with disease, a spew-drink of lupin, bishopswort, henbane, garlic. Pound these together, add ale and holy water."

And again: "A drink for a fiend-sick man, to be drunk out of a church-bell: Githrife, cynoglossum, yarrow, lupin, flower-de-luce, fennel, lichen, lovage. Work up to a drink with clear ale, sing seven masses over it, add garlic and holy water, and let the possessed sing the *Beati Immaculati*; then let him drink the dose out of a church-bell, and let the priest sing over him the *Domine Sancte Pater Omnipotens.*" *

Had this been the worst treatment of lunatics developed in the theological atmosphere of the middle ages, the world would have been spared some of the most terrible chapters in its history; but, unfortunately, the idea of the Satanic possession of lunatics led to attempts to punish the indwelling demon. As this theological theory and practice became more fully developed, and ecclesiasticism more powerful to enforce it, all mildness began to change, or to be driven into remote corners of Christendom; the admonitions to gentle treatment by the great pagan and Moslem physicians were forgotten, and the treatment of lunatics tended more and more toward severity; more and more generally it was felt that cruelty to madmen was punishment of the devil residing within or acting upon them.

A few strong churchmen and laymen made efforts to resist this tendency. As far back as the fourth century, Nemesius, Bishop of Emesa, accepted the truth as developed by pagan physicians, and aided them in strengthening it. In the seventh century, a Lombard code embodied a similar effort. In the eighth century, one of Charlemagne's capitularies seems to have had a like purpose. In the ninth century, that great churchman and statesman, Agobard, Archbishop of Lyons, superior to his time in this as in so many other things, tried to make right reason prevail in this field; and, near the beginning of the tenth century, Regino, Abbot of Prüm, in the diocese of Treves, insisted on treating possession as disease. But all in vain; the current streaming most directly from sundry texts in the Christian sacred books, and swollen by theology, had become overwhelming.†

* See Cockayne, "Leechdoms, Wort-cunning, and Star-Craft of Early England" (in the Rolls Series), ii, 177; also 355, 356. For the great value of priestly saliva, see W. W. Story's interesting essays.

† For a very thorough and interesting statement on the general subject, see Kirchhof,

The first great tributary poured into this stream, as we approach the bloom of the middle ages, appears to have come from the brain of Michael Psellus. Mingling scriptural texts, Platonic philosophy, and theological views of great doctors of the Church, with wild statements obtained from lunatics, he gave forth, about the beginning of the twelfth century, a treatise on "The Work of Demons." "Sacred science" was vastly enriched thereby in various ways; but two of his conclusions, the results of his most profound thought, enforced by theologians and popularized by preachers, soon took a special hold upon the thinking portion of the people at large. The first of these, which he easily based upon Scripture and St. Basil, was that, since all demons suffer by material fire and brimstone, they must have material bodies; the second was that, since all demons are by nature cold, they gladly seek a genial warmth by entering the bodies of men and beasts.*

Fed by this stream of thought, and developed in the warm atmosphere of mediæval devotion, the idea of demoniacal possession as the main source of lunacy grew and blossomed and bore fruit in noxious luxuriance.

There had, indeed, come into the middle ages an inheritance of scientific thought. The ideas of Hippocrates, Celius Aurelianus, Galen, and their followers, were from time to time revived; the Arabian physicians, the school of Salerno, such writers as Salicetus, Guy de Chauliac, and even some of the religious orders, did something to keep scientific doctrines alive; but the tide of theological thought was too strong—it became dangerous even to seem to name possible limits to diabolical power. To deny Satan was atheism; and perhaps nothing did so much to fasten the epithet "atheist" upon the medical profession as the suspicion that it did not fully acknowledge diabolical interference in mental disease. Of this feeling we have a monument in the mediæval proverb, "Where there are three physicians there are two atheists." Fol-

"Beziehungen des Dämonen- und Hexenwesens zur deutschen Irrenpflege," in the "Allgemeine Zeitschrift für Psychiatrie," Berlin, 1888, Bd. xliv, Hft. 25. For Roman Catholic authority, see Addis and Arnold, "Catholic Dictionary," article "Emergumens." For a brief and eloquent summary, see Kraft-Ebing, "Lehrbuch der Psychiatrie," as above; and, for a clear view of the transition from pagan mildness in the care of the insane to severity and cruelty under the Christian Church, see Maudsley, "The Pathology of Mind," London, 1879, p. 523. See also Buchmann, "Die unfreie und die freie Kirche," Breslau, 1873, p. 251. For other citations, see Kirchhof, as above, pp. 334–336. For Bishop Nemesius, see "Trélat," p. 48. For an admirable account of Agobard's general position in regard to this and allied superstitions, see Reginald Lane Poole's "Illustrations of the History of Mediæval Thought," London, 1884.

* See Baas and Werner, cited by Kirchhof, as above; also Lecky, "Rationalism in Europe," i, 68, and note, New York, 1884. As to Basil's belief in the corporeality of devils, see his "Commentary on Isaiah," cap. i.

lowing in the lines of the earlier fathers, St. Anselm, Abélard, St. Thomas Aquinas, Vincent de Beauvais, all the great doctors in the mediæval Church, some of them in spite of occasional misgivings, upheld the idea that insanity is largely or mainly demoniacal possession, basing their belief steadily on the sacred Scriptures; and this belief was followed up in every quarter by more and more constant citation of the text "Ye shall not suffer a witch to live." No other text of Scripture—save, perhaps, one—has caused the shedding of so much innocent blood.

As we look over the history of the middle ages, we do, indeed, see another development from which one might hope much; for there were two great streams of influence in the Church—and never were two powers more truly unlike each other.

On one side was the spirit of Christianity, as it proceeded from the heart and mind of its blessed Founder, immensely powerful in aiding the evolution of religious thought and effort, and especially of provision for the relief of suffering by religious asylums and tender care. Nothing better expresses this than the touching words inscribed upon a great mediæval hospital, "*Christo in pauperibus suis.*" But on the other side was the theological theory—proceeding, as we have seen, from the survival of ancient superstitions, and sustained by constant reference to the texts in our sacred books—that many, and probably most, of the insane were possessed by the devil or in league with him, and that the cruel treatment of lunatics was simply punishment of the devil and his minions. By this current of thought was gradually developed one of the greatest masses of superstitious cruelty that has ever disgraced humanity. At the same time the stream of Christian endeavor, so far as the insane were concerned, was almost entirely cut off. In all the beautiful provision during the middle ages for the alleviation of human suffering, there was for the insane almost no care. Some monasteries, indeed, gave them refuge. We hear of a charitable work done for them at the London Bethlehem Hospital in the thirteenth century, at Geneva in the fifteenth, at Marseilles in the sixteenth, by the Black Penitents in the south of France, by certain Franciscans in northern France, by the Alexian Brothers on the Rhine, and by various agencies in other parts of Europe.

Curiously enough, the only really important effort in the Christian Church was stimulated by the Mohammedans. Certain monks, who had much to do with them in redeeming Christian slaves, found in the fifteenth century what John Howard found in the eighteenth, that the Arabs and Turks made a large and merciful provision for lunatics, such as was not seen in Christian lands; and this example led to better establishments in Spain and Italy.

All honor to this work and to the men who engaged in it; but, as a rule, these establishments were few and poor, compared with those for other diseases, and they usually degenerated into madhouses, where devils were cast out mainly by cruelty.*

The first main weapon against the indwelling Satan continued to be the exorcism; but, under the influence of inferences from Scripture farther and farther fetched, and of theological reasoning more and more subtle, it became something very different from the gentle procedure of earlier times, and some description of this great weapon at the time of its highest development will throw light on the laws which govern the growth of theological reasoning, as well as upon the main subject in hand.

A fundamental premise in the fully developed exorcism was that, according to sacred Scripture, a main characteristic of Satan is pride. Pride led him to rebel—for pride he was cast down; therefore the first thing to do, in driving him out of a lunatic, was to strike a fatal blow at this pride—to disgust him.

This theory was carried out logically, to the letter. The treatises on the subject simply astound one by their wealth of epithets—blasphemous and obscene—which it was allowable for the exorcist to use in casting out devils. The "Treasury of Exorcisms" † contains hundreds of pages packed with the vilest epithets which the worst imagination could invent for the purpose of overwhelming the indwelling Satan.

Some of those decent enough to be printed in these degenerate days ran as follows:

"Thou lustful and stupid one, . . . thou lean sow, famine-stricken and most impure, . . . thou wrinkled beast, thou mangy beast, thou beast of all beasts the most beastly, . . . thou mad

* For a very full and learned, if somewhat one-sided, account of the earlier effects of this stream of charitable thought, see Yollemer, "Des Origines de la Charité Catholique," Paris, 1858. It is instructive to note that, while this book is very full in regard to the action of the Church on slavery and on provision for the widows and orphans, the sick, the infirm, captives, and lepers, there is hardly a trace of any care for the insane. This same want is incidentally shown by a typical example in Kriegk, "Aerzte, Heilanstalten und Geisteskranke im mittelalterlichen Frankfurt," Frankfurt a. M., 1863, pp. 16, 17; also Kirchhof, pp. 396, 397. On the general subject, see Semelaigne, as above, p. 214; also Lecky, "Rationalism in Europe," i, 88; also Calmeil, i, 116, 117. For the effect of Moslem example in Spain and Italy, see Kraft-Ebing, as above, p. 45, note.

† "Thesaurus Exorcismorum atque Conjurationum terribilium, potentissimorum, efficacissimorum, cum PRACTICA probatissima: quibus spiritus maligni, Dæmones Maleficiaque omnia de Corporibus humanis obsessis, tanquam Flagillis Fustibusque fugantur, expelluntur," . . . Cologne, 1626. Many of the books of the exorcists were put upon the various indexes of the Church, but this, the richest collection of all, and including nearly all those condemned, was not prohibited until 1709. Scarcely less startling manuals continued even later in use; and exorcisms adapted to every emergency may, of course, still be found in all the Benedictionals of the Church—even the latest. As an example, see the "Manuale Benedictionum" published by the Bishop of Passau in 1849.

spirit, . . . thou bestial and foolish drunkard, . . . most greedy wolf, . . . most abominable whisperer, . . . thou sooty spirit from Tartarus! . . . I cast thee down, O Tartarean boor, into the infernal kitchen! . . . Loathsome cobbler, . . . dingy collier, . . . filthy sow (*scrofa stercorata*), . . . perfidious boar, . . . envious crocodile, . . . malodorous drudge, . . . wounded basilisk, . . . rust-colored asp, . . . swollen toad, . . . entangled spider, . . . lousy swineherd (*porcarie pedicose*), . . . lowest of the low, . . . cudgeled ass," etc.

But, in addition to this attempt to disgust Satan's pride with blackguardism, there was another to scare him with tremendous words. For this purpose, great, sounding names, from Hebrew and Greek, of the Deity were imported, such as Acharon, Eheye, Schemhamphora, Tetragrammaton, Homousion, Ho Theos, Athanatos, Ischiros, Æcodes, and the like.*

Efforts were also made to drive him out with filthy and rank-smelling drugs; and, among those which can be mentioned in a printed article, we may name asafœtida, sulphur, squills, etc., which were to be burned under his nose.

Still further to plague him, pictures of the devil were to be spat upon, trampled under foot by people of low condition, and sprinkled with foul compounds.

But these were merely preliminaries to the exorcism proper. In this the most profound theological thought and sacred science of the period culminated.

Most of its forms were childish, but some rise to almost Miltonic grandeur. As an example of the latter, we may take the following:

"By the Apocalypse of Jesus Christ, which God hath given to make known unto his servants those things which are shortly to take place; and hath signified, sending by his angel, . . . I exorcise you, ye angels of untold perversity!

"By Him that is the faithful witness, the first-born among the dead, and the Prince of the kings of the earth, . . . I exorcise you, ye dwellers in the regions of hell!

"And by Him that loved us, and washed us of our sins in his blood, . . . and behold, he cometh in clouds, and every eye shall see him, and they also who pierced him; and all the tribes of the earth shall weep before him; . . . and by all the wondrous signs, terrible voices, mighty thunders, and mystic visions which St. John beheld, I exorcise you, O angels who entice unto evil deeds, that ye do go far away from this creature!

"By the seven golden candlesticks, . . . and by one like unto the Son of man, standing in the midst of the candlesticks; by

* See the *Conjuratio* on p. 300 of the "Thesaurus," and the general directions given on pp. 251, 252.

this voice, as the voice of many waters; . . . by his words, 'I am living, who was dead; and behold, I live forever and ever; and I have the keys of death and of hell,' I say unto you, Depart, O angels that show the way to eternal perdition!

"By the door which John saw open in heaven; by the twenty-four thrones and the twenty-four elders, . . . and by the lightnings and thunders and voices which proceeded out from the throne; . . . by the sea which he saw, as it were of glass mingled with fire, . . . and by the four living beings full of eyes before and behind; . . . by the words which they incessantly did say, 'Holy, holy, holy, Lord God Almighty, that was, and that is, and that is to come'; . . . by the angel who cried out, 'Who is worthy to open the book, and to loose the seals?' . . . by the Lamb, as it were slain; . . . by the harps and by the vials of gold, full of perfumes, I charge ye, O angels of death, to flee quickly out of this creature!"

Besides these, were long litanies of billingsgate, cursing, and threatening. One of these "scourging" exorcisms runs partly as follows:

"May Agyos strike thee, as he did Egypt, with frogs! . . . May all the devils that are thy foes rush forth upon thee, and drag thee down to hell! . . . May . . . Tetragrammaton . . . drive thee forth and stone thee, as Israel did to Achan! . . . May the holy one trample on thee and hang thee up in an infernal fork, as was done to the five kings of the Amorites! . . . May God set a nail to your skull, and pound it in with a hammer, as Jael did unto Sisera! . . . May . . . Sother . . . break thy head and cut off thy hands, as was done to the cursed Dagon! . . . May God hang thee in a hellish yoke, as seven men were hung by the sons of Saul!" And so on, through five pages of close-printed Latin curses.*

Occasionally the demon is reasoned with, as follows: "O obstinate, accursed, fly! . . . why do you stop and hold back when you know that your strength is lost on Christ? For it is hard for thee to kick against the pricks; and, verily, the longer it takes you to go, the worse it will go with you. Begone, then, take flight, thou venomous hisser, thou lying worm, thou begetter of vipers!"†

And this procedure and its results were recognized as among the glories of the Church. As typical, we may mention an exorcism directed by a certain Bishop of Beauvais, which was so effective that five devils gave up possession of a sufferer and signed their names, each for himself and his subordinate imps, to an agreement that the possessed should be molested no more. So, too, the Jesuit fathers at Vienna, in 1583, gloried in the fact that

* "Thesaurus Exorcismorum," 812–817. † Ibid., 859.

in such a contest they had cast out twelve thousand six hundred and fifty-two living devils. The ecclesiastical annals of the middle ages, and, indeed, of a later period, abound in boasts of such "mighty works."*

Such was the great result of a thousand years of theological reasoning, by the strongest minds in Europe, upon data given in Scripture regarding Satan and his work among men. Such were the results and remedies arrived at by the highest development of "sacred science."

Under the guidance of theology, always so severe against "science falsely so called," the world had come a long way indeed from the soothing treatment of the possessed by Him who bore among the noblest of his titles that of "The Great Physician." The result was natural: the treatment of the insane fell more and more into the hands of the jailer, the torturer, and the executioner.

To go back for a moment to the beginnings of this unfortunate development. In spite of the earlier and more kindly tendency in the Church, the Synod of Ancyra, as early as 35 A. D., commanded the expulsion of possessed persons from the Church; the Visigothic Christians whipped them; and Charlemagne, in spite of some good enactments, imprisoned them. Men and women, whose distempered minds might have been restored to health by gentleness and skill, were driven into hopeless madness by noxious medicines and brutality. Some few were saved as mere lunatics —they were surrendered to general carelessness, and became simply a prey to ridicule and aimless brutality; but vast numbers were punished as tabernacles of Satan.

One of the least terrible of these punishments, and perhaps the most common of all, was that of scourging demons out of the body of a lunatic. This method commended itself even to the judgment of so thoughtful and kindly a personage as Sir Thomas More, and as late as the sixteenth century. But if the disease continued, as it naturally would after such treatment, the authorities frequently felt justified in driving out the demons by torture.†

Interesting monuments of this idea, so fruitful in evil, still exist. In the great cities of central Europe, "witch-towers," where witches and demoniacs were tortured, and "fool-towers," where the more gentle lunatics were imprisoned, may still be seen.

* In my previous chapters—especially that on meteorology—I have quoted extensively from the original treatises, of which a very large collection is in my possession; but in this chapter I have largely availed myself of the copious translations given by M. H. Dziewicki, in his excellent article in the "Nineteenth Century" for October, 1888, entitled "Exorcizo Te." For valuable citations on the origin and spread of exorcism, see Lecky's "European Morals" (third English edition), i, 379–385.

† For prescription of the whipping-post by Sir Thomas More, see D. H. Tuke's "History of Insanity in the British Isles," London, 1882, pp. 29, 30.

In the cathedrals, too, we still see this idea fossilized. Devils and imps, struck into stone, clamber upon towers, prowl under cornices, peer out from bosses of foliage, perch upon capitals, nestle under benches, flame in windows. Above the great main entrance, the most common of all representations still shows Satan and his imps scowling, jeering, grinning, while taking possession of the souls of men and scourging them with serpents, or driving them with tridents, or dragging them with chains, into the flaming mouth of hell. Even in the most hidden and sacred places of the mediæval cathedral we still find representations of Satanic power in which profanity and obscenity run riot. In these representations the painter and glass-stainer vied with the sculptor. Among the early paintings on canvas a well-known example represents the devil in the shape of a dragon, perched near the head of a dying man, eager to seize his soul as it issues from his mouth, and only kept off by the efforts of the attendant priest. Typical are the colossal portrait of Satan, and a vivid picture of the devils cast out of the possessed and entering into the swine, as shown in the cathedral-windows of Strasburg. So, too, in the windows of Chartres Cathedral we see a saint healing a lunatic—the saint, with a long devil-scaring formula in Latin issuing from his mouth; and the lunatic, with a little detestable hobgoblin, horned, hoofed, and tailed, issuing from *his* mouth. These examples are but typical of myriads in cathedrals and abbeys and parish churches throughout Europe; and all served to impress upon the popular mind a horror of everything called diabolic, and a hatred of those charged with it. These sermons in stones preceded the printed book; they were a sculptured edition of the Bible, which preceded the pictorial editions of Luther's printed Bible.*

Satan and his imps were among the principal personages in every popular drama, and "Hell's Mouth" was a piece of stage scenery constantly brought into requisition. A miracle-play, without a full display of the diabolic element in it, would have stood a fair chance of being pelted from the stage.†

* I cite these instances out of a vast number which I have personally noted in visits to various cathedrals. For striking examples of mediæval grotesques, see Wright's "History of Caricature and the Grotesque," London, 1875; Langlais's "Stalles de la Cathédrale de Rouen," 1838; Champfleury's "Les Sculptures Grotesques et Symboliques," Rouen, 1879; Viollet le Duc, "Dictionnaire de l'Architecture"; Gailhabaud, "Sur l'Architecture," etc.

† See Wright, "History of Caricature and the Grotesque"; F. J. Mone, "Schauspiele des Mittelalters," Carlsruhe, 1846; Dr. Karl Hase, "Miracle Plays and Sacred Dramas," Boston, 1880 (translation from the German). Examples of the miracle-plays may be found in Mone; in Mariott's "Collection of English Miracle-Plays," Basil, 1838; in Hone's "Ancient Mysteries"; in T. Sharp's "Dissertation on the Pageants . . . anciently performed at Coventry," Coventry, 1828; in the publications of the Shakespearean and other societies. See especially the "Harrowing of Hell," a miracle-play, edited from the original now in the British Museum, by T. O. Halliwell, London, 1840. One of the items still preserved is a

The especial point to be noted is that from the miracle-play of the present day Satan and his works have disappeared. The writer of this article was unable to detect, in a representation of the passion-play at Ober-Ammergau, in 1881, the slightest reference to diabolic interference with the course of events as represented from the Old Testament, or from the New, in a series of tableaux lasting, with a slight intermission, from nine in the morning until after four in the afternoon. With the most thorough exhibition of minute events relating the life of Christ, and at times with hundreds of figures on the stage, there was not a person or a word which recalled that main feature in the mediæval Church plays. The writer also made a full collection of photographs of tableaux, of engravings of music, and of works bearing upon these representations for twenty years before, and in none of these was there an apparent survival of the old belief. This would certainly seem to indicate that even the child-like faith of the Tyrolese has arrived at a point, under modern influences, which would make a representation of Satan and his minions incongruous; and that, while they believe that they believe, diabolism as a belief to be openly professed has become a thing to provoke derision.*

Not only the popular art, but all the popular legends embodied these ideas. The stories of the chroniclers are full of them; the "Lives of the Saints" abound in them; sermons enforced them from every pulpit. What wonder, then, that soon men and women had vivid dreams of Satanic influence, that dread of "possession" was like dread of the plague, and that this terror spread the disease enormously, until we hear of convents, villages, and even large districts ravaged by epidemics of diabolical possession!†

And this terror naturally bred not only active cruelty toward those supposed to be possessed, but cold indifference to the sufferings of those acknowledged to be lunatics. As we have already seen, while ample and beautiful provision was made for every other form of human suffering, for this there was comparatively little; and, indeed, what provision was made was generally worse than none. Of this indifference and cruelty we have a striking monument in a single English word—a word originally significant

sum of money paid for keeping a fire burning in hell's mouth. Says Hase (as above, p. 42): "In wonderful satyr-like masquerade, in which neither horns, tail, nor hoofs were ever . . . wanting, the devil prosecuted on the stage his business of fetching souls," which left the mouths of the dying "in the form of small images."

* Speaking of the part played by Satan at Ober-Ammergau, Hase says: "Formerly, seated on his infernal throne, surrounded by his hosts with Sin and Death, he opened the play, . . . and . . . retained throughout a considerable part; but he has been surrendered to the progress of that enlightenment which even the Bavarian highlands have not been able to escape" (p. 80).

† I shall discuss these epidemics of possession, which form a somewhat distinct class of phenomena, in the second part of this chapter.

of gentleness and mercy, but which became significant of wild riot and brutality and confusion—Bethlehem Hospital became "Bedlam."

Modern art has also dwelt upon this theme, and perhaps the most touching of all its exhibitions is the picture by a great French master representing a tender woman bound to a column, and exposed to the jeers, insults, and missiles of street ruffians.*

Here and there, even in the worst of times, men arose who attempted to promote a more humane view, but with little effect. One expositor of St. Matthew, having ventured to recall the fact that some of the insane were spoken of in the New Testament as madmen, and to suggest that their madness might be caused by the moon, was answered that their madness was not caused by the moon, but by the devil, who avails himself of the moonlight for his work.†

One result of this idea was a mode of cure which especially aggravated and spread mental disease—the promotion of great religious processions. Troops of men and women, crying, howling, imploring saints, beating themselves with whips, visited various sacred shrines, images, and places, in the hope of driving off the powers of evil. The only result was an increase in the numbers of the diseased.

For hundreds of years this idea of diabolic possession was steadily developed. It was believed that devils entered into animals; and animals were accordingly exorcised, tried, tortured, convicted, and executed. The great St. Ambrose tells us that a priest, while saying mass, was troubled by the croaking of frogs in a neighboring marsh, and that he exorcised them, and so stopped their noise. St. Bernard, as the monkish chroniclers tell us, mounting the pulpit to preach in his abbey, was interrupted by a cloud of flies; straightway the saint uttered the sacred formula of excommunication, when the flies fell dead upon the pavement in heaps, and were cast out with shovels! A formula of exorcism attributed to a saint of the ninth century, and which remained in use down to a recent period, especially declares insects injurious to crops to be possessed of evil spirits, and names, among the animals to be excommunicated or exorcised, mice, moles, and serpents. The use of exorcism against caterpillars and grasshoppers was also common. In the thirteenth century the Bishop of Lausanne, finding that the eels in Lake Leman troubled the fishermen, attempted to remove the difficulty by exorcism.

* The typical picture representing a priest's struggle with the devil is in the city gallery of Rouen. The modern picture is Robert Fleury's painting in the Luxembourg Gallery at Paris.

† See Giraldus Cambrensis, cited by Tuke, as above, p. 79.

Did any one venture to deny that animals could be possessed by Satan, he was at once silenced by reference to the entrance of Satan into the serpent in the garden of Eden, to the transformation of Nebuchadnezzar, and to the casting of the devils into the swine by the founder of Christianity himself.*

One part of this superstition most tenaciously held was the belief that a human being could be changed into the form of an animal. This became, indeed, a fundamental point. The most dreaded of predatory animals in the middle ages were the wolves. Driven from the hills and forests in the winter by hunger, they not only devoured the flocks, but sometimes came into the villages and seized children. From time to time men and women whose brains were disordered dreamed that they had been changed into various animals, and especially into wolves. Confessing this, and often implicating others, many executions of lunatics resulted; not to mention here the countless sane victims who, suspected of the same impossible crime, were forced by torture into confession of it, and sent unpitied to the stake. The belief in such a transformation pervaded all Europe, and lasted long, even in Protestant countries; probably no article in the witch creed had more adherents in the fifteenth, sixteenth, and seventeenth centuries than this. Nearly every parish in Europe had its resultant horrors.

The Reformed Church in all its branches fully accepted the doctrines of witchcraft and diabolic possession, and developed them still further. No one urged their fundamental ideas more fully than Luther. He did, indeed, reject portions of the witchcraft folly; but to the influence of devils he not only attributed his maladies but his dreams, and nearly everything that thwarted or disturbed him. The flies which lighted upon his book, the rats which kept him awake at night, he believed to be devils; the resistance of the Archbishop of Mayence to his ideas, he attributed to Satan literally working in that prelate's heart; to his disciples he told stories of men who had been killed by rashly resisting the devil. Insanity, he was quite sure, was caused by Satan, and he exorcised sufferers. Against some he appears to have advised stronger remedies; and his horror of idiocy, as resulting from satanic influence, was so great that on one occasion he appears to have advised the killing of an idiot child, as being the direct offspring of Satan. Yet Luther was one of the most tender and loving of men; in the whole range of literature there is hardly anything more touching than his words and tributes to children. In enforcing his ideas he laid stress especially upon the question of St. Paul as to the bewitching of the Galatians, and, in the case

* See Menabrea, "Procès au Moyen Age contre les Animaux," Chambéry, 1846, pp. 81 and following.

of idiocy, on the account in Genesis of the birth of children whose fathers were "sons of God" and whose mothers were "daughters of men."

One idea of his was especially characteristic. The descent of Christ into hell was a frequent topic of discussion in the Reformed Church; Melanchthon, with his love of Greek studies, held that the purpose of the Saviour was to make himself known to the great and noble men of antiquity—Plato, Socrates, and the rest; but Luther insisted that his purpose was to conquer Satan in a hand-to-hand struggle.

This idea of diabolic influence pervaded his conversation, his preaching, and his writings, and spread thence to the Lutheran Church in general.

Calvin also held to the same theory; and, having more power, with less kindness of heart, than Luther, carried it out with yet greater harshness.

Under the influence, then, of such infallible teachings, in the older Church and in the new, this superstition was developed more and more into cruelty; and, as the Biblical texts, popularized in the sculptures and windows and mural decorations of the great mediæval cathedrals, had done much to develop it among the people, so Luther's translation of the Bible, especially in the numerous editions of it illustrated with engravings, wrought with enormous power to spread and deepen it. In every peasant's cottage some one could spell out the story of the devil bearing Christ through the air and placing him upon the pinnacle of the Temple,—of the woman with seven devils,—of the devils cast into the swine. Every peasant's child could be made to understand the quaint pictures in the family Bible or the catechism which illustrated vividly all those texts. In the ideas thus deeply implanted, the men who in the seventeenth and eighteenth centuries struggled against this mass of folly and cruelty found the worst barrier to right reason.*

So was the treatment of demoniacs developed by theology; and such was the practice enforced by ecclesiasticism for more than a thousand years.

How an atmosphere was spread in which this belief began to dissolve away, how its main foundations were undermined by science, and how there gradually came in a reign of humanity, will be related in the next chapter.

* As to the grotesques in mediæval churches, the writer of this article, in visiting the town church of Wittenberg, noticed just opposite the pulpit where Luther so often preached, a very spirited figure of an imp peering out upon the congregation. One can but suspect that this mediæval survival frequently suggested Luther's favorite topic during his sermons.

PHYSICAL TRAINING OF YOUNG CHILDREN.

By M. FERNAN LAGRANGE.

IT would be a great mistake to apply, in the physical training of children, the same principles as those by which gymnastics for adults is adapted. And as we recognize different grades in the intellectual teaching of children, corresponding with their different ages, so the exercises prescribed for them should vary, to correspond with the different degrees of their bodily development. The child's gymnastics should be quite distinct from that which is considered best suited to mature age. It should not look to utility, but should serve an exclusively hygienic end. The first object should be to give good carriage, to aid the pupils in reaching a full maximum of growth, and see that they are developed regularly, without deformity and without blemishes. All these conditions are within the domain of hygiene. A second feature of the exercise adapted to children regards the cerebral conditions which result from their being at school. They require diversion from the mental work that is put upon them, and such diversion can be obtained only by giving them the pleasure of recreation.

Hence, we have the two essential features that should be secured in infant gymnastics—the hygienic and the recreative.

The usual school gymnastics lacks much of being irreproachable from the hygienic point of view. Some of the methods seem to have been chosen rather because they were convenient of application than on account of any hygienic value. They are not adapted so much to the requirements of the child as to the accommodations of the school premises. Methods have been sought by which they could be applied in narrow spaces, and considerable muscular effort called out in a very short time. It may be convenient to collect a class of children once or twice a week and make them perform vigorous movements, but it is hardly what their hygiene demands. To measure out approximately the amount of exercise that ought to be taken in a week and administer it all at once is no more valid than it would be to give food for several days at a single meal. The child's exercise should be as carefully allotted to him as his food, and excessive fatigue as sedulously avoided as indigestion. A system of giving gymnastic exercises at too long intervals involves the dilemma that too great exertion may be called out at each lesson, or, if the labor is moderated, too little will be done. The child does not want intense effort at rare intervals, but moderate exercises frequently repeated.

The fact that intense muscular effort interferes with the de-

velopment of the growing infant in height is perhaps less well known to hygienists and physicians than to veterinary surgeons and trainers. It has long been observed that young horses which are put to work too early never become as large as their fellow-colts which are allowed to reach their full growth in the pasture. Gymnastic apparatus, with the efforts which they necessitate, would have on the child the same dwarfing influence as harnessing to the wagon or the plow upon the colt. The infant prodigies of the circus sufficiently exemplify this fact. With all the skill they display, they seldom exhibit well-grown, evenly developed forms, but are usually in some way distorted; and persons who have begun hard work on farms or as laborers too early in life are generally stunted. Besides being unevenly distributed in time, these exercises are badly localized as to the different parts of the body. All exercises with fixed apparatus—the trapeze, the stationary bar, rings, parallel bars, slack rope, etc.—throw the work wholly upon the upper part of the body, leaving the muscles of the pelvis and lower limbs comparatively inactive. This is not so much matter with city men, who have to walk a great deal; but is a very important consideration with children at school, who spend most of their time sitting on benches.

In children muscular effort should be generalized, so as to make as great a number of muscles as possible participate in it, or at least to distribute it judiciously among the stronger muscles. When each group of muscles shares in the exercise according to its strength, the labor is less fatiguing, and we are able to obtain the general benefit of exercise—which is the communication of the highest activity of the circulation and respiration, without incurring the harmful results which are forms of fatigue. This benefit is more conveniently obtained through exercise of the legs than of the arms, because they are stronger and can bear more work without fatigue. In such exercises, of which running is the type, not only the legs but the pelvis, the vertebral column, the shoulders, and the arms, all participate. Exercises in which the work is localized, however much they may contribute to the development of the active part in the adult, do not have that effect in children, the volume of whose muscles is never increased by them. They are consequently useless, while they promote fatigue. They are liable to the further objection that they tend to produce deformities in young children subjected to them, whose plastic frames at their tender age yield very readily to any stress which is put upon them, and acquire a permanent set if it is repeated too often. Partisans of gymnastics plead, in answer to this objection, that their system may be and is used to correct bodily deformities; but the plea really strengthens the argument against the system, for the same structure that yields to a correct-

ive application of gymnastic exercise will yield as readily to a distorting one. It is only when the frame has become mature and firmly set that such exercises can be applied without danger and to advantage; and that they are then useful when rightly applied can not be gainsaid.

These objections do not lie against floor exercises, or light gymnastics, which are not performed with fixed apparatus. In these, the child bends, stretches, and shifts his arms, legs, head, and body in various directions, at the command of the teacher, in measured rhythm. These motions are hygienically irreproachable. They do not exact any very intense muscular effort, or vicious attitude of the body, or abnormal use of the limbs. But even when performed in concert they are not recreations, and this is an extremely important matter with pupils whose brains are working to excess. They become exceedingly monotonous, and the child begins to perform them reluctantly, or learns to partly evade them. Although he can hardly escape going through the visible motion, he can easily avoid the muscular effort without which it is ineffective. The evasion may, it is true, be corrected by strict vigilance on the part of the teacher; but what becomes then of the distraction, of the mental relaxation which the pupil ought to find in his physical training? To compel one to the performance of the motions is no way to make him love his exercise. In this way the pupil finds in them, not a recreation, but a lesson additional to the others—a new burden. Now, recreation is not only a moral want of the child, but it is an important physical need, in so far as it furnishes a remedy for the nervous weakness and irritability that are induced by constant constraint, and helps to prevent disturbance of the equilibrium of the vital functions. Both of the gymnastic systems of physical education, therefore, lack the important essentials of being hygienic and recreative.

The prime fault of both these kinds of gymnastic exercise is that they are artificial. They were introduced for the praiseworthy purpose of supplying the want of natural exercise where that could not be obtained; but they have gone beyond this, and the notion has arisen that a child can not take proper exercise without going through an apprenticeship and being subjected to a method: the more complicated the method, and the more difficult the apprenticeship, the better the results that are anticipated. The elaborate gymnastics, which many regard as a kind of perfection of natural exercise, is, from the hygienic point of view, nothing but a make-shift when we can get no better means, but a poor substitute for the spontaneous gymnastics to which every child is naturally inclined. This instinctive exercise would amply suffice for the development of the body if the instinct was listened to every time it speaks, but social and scholar conditions do not per-

mit this. The instinctive desire, repressed too often, becomes weakened, and finally disappears. The body accommodates itself to a sedentary life, and the insufficiency of exercise finally induces muscular indolence and an inert habit. The teacher of gymnastics would not be needed if the pupil had the privilege every day, for a sufficient time, of a large space, and liberty to amuse himself in it.

Why, then, erect halls and apparatus if we can have the privilege of a spacious sward or a garden with broad walks? While gymnastic apparatus may be useful where there is not room to provide other means, what is to be said of heads of families having ample spaces in the country, with all desired conditions for natural gymnastics, who go to the trouble of constructing gymnasiums for their children? The tendency to look for the best misses its mark nowhere more sadly than in the physical education of the child, when it prefers complicated processes to natural methods, and neglects the best hygienic means as too simple or insufficient. In the belief that the child can not take proper exercise without apparatus, when no apparatus is at hand no exercise is taken. He must have a special master for the exercise, and his taking it is made to depend on the master—to such an extent, that no one in the family thinks of the child's doing anything outside of the regulation lessons.

Instinctive gymnastics is, from the hygienic point of view, the best adapted to the regular development of the child. It is not liable to any of the objections we have brought against gymnastics with apparatus. It can not deform the body, for it is made up of spontaneous movements, and conformed to the natural office of each limb. It does not localize the work in a particular region of the body, for all the limbs are instinctively invited to take their quota of exercise; and it does not seduce the child into efforts touching upon the limits of his strength. Instinct also invites him to the kind of work which is best adapted to his particular aptitudes for resisting fatigue. He has a natural disposition to perform light but frequently recurring acts, quick motions, which put him out of breath, while exercises with apparatus rather exact slow and intense efforts that bring on local fatigue. Now, all observers have noticed the wonderful facility with which a child recovers his breath, and his impatience of local fatigue. Finally, natural exercise, being the satisfaction of a want, is by that very fact a pleasure; and joy shines in the face of the child who is playing freely.

The partisans of artificial gymnastics object to this method that it does not give in mature age the great muscular force, the capacity to bear fatigue, and the refined dexterity of movements—the various athletic and acrobatic qualities, in short, that should

result from a complete physical education; and they assume that these superior qualities of the picked man, to be given the fullest vigor, should be cultivated from a tender age. They fall into the mistake, which is too often made in physical education, of not distinguishing between methods of development and perfecting processes. The physical education of the child, up to his fifteenth year, should have for its sole object to favor the growth of the body in all directions, particularly in height and weight; the perfecting of the structure of the organs, and the training of them by methodical exercise to a more complete performance, should come later on. The fourteenth year will be early enough to begin more energetic motions for hardening the flesh and developing the muscles. Till that age, physical education should especially aim to remove from the child all influences that may be in the way of the free expansion and growth of the body. Among these harmful influences are two of opposite character that produce nearly identical results—want of exercise, which makes the child emaciated, and excess of work, which stunts him.

This important distinction between developing and perfecting hygiene is well understood and observed by horse-trainers. They give colts nourishing food, free air, and room to gambol; and do not begin training them for work till they have acquired bodily growth and substance.

If natural gymnastics is enough for the animal, we may conclude from analogy that it would be amply sufficient for the child, if he had the conditions of space and time that are indispensable to the satisfaction of the instinct that impels him to exercise. When, then, the social conditions to which the child is subjected do not permit him to indulge in instinctive exercise, gymnastic methods as like as possible to those which instinct suggests should be sought for him.

The form of exercise that comes nearest to natural exercise is playing. It is nothing else than a more or less methodical regulation of the instinctive motions, such as every living being is prone to execute spontaneously when he feels the stress of the want of exercise. It may be called a natural exercise, for we see the young of every species of animals playing with one another, and may even observe their parents inciting them to play. The teaching of plays, which we find in all countries and ages, originates, we may suppose, in this tendency of the living being to educate his progeny physically by exciting him to enjoy himself in motion. Play, in the progress of civilization, has taken various forms, and has been subjected to methods that tend more and more to introduce into it an artificial element. Hence, sport has been developed from plays; the exercises called sports are in general simply plays that have taken a more methodical form, per-

mitting a greater display of muscular force, exacting more complicated motions and a longer apprenticeship. It is sometimes hard to draw a clear line between sport and play. Fencing, equitation, and canoeing are varieties of sport. Cricket is as much a play for children as an exercise of sport; in short, in the hygienic view, sports are half-way between gymnastics and play, and are therefore more suitable to youth than to children.

Plays give the form of gymnastics most congenial to the conditions of social life, for they are at the same time hygienic and recreative, and are as well adapted to the physical requirements of the child as to his moral needs. Physically regarded, they demand neither very intense efforts nor localized muscular contractions. Even the most complicated of them call out nothing more than combinations of simple movements and natural attitudes; while gymnastics necessitates abnormal combinations in the association of the muscles, with movements which the child, having never practiced, has to learn laboriously. Play presents no difficulties comparable to those offered by gymnastics. If the child has not yet become adept in the game, he will play badly and lose his part; but he will play, and will at least gain the physical advantages of exercise. But when he is dealing with the abnormal motions or "turns" of gymnastics, if he has not yet learned the way of executing them, or acquired the knack, which it often takes a long time to gain, he only makes a pretense of exercising, and his effort is limited to a fruitless tentative, without any effective activity.

Besides the support of reason and observation, the method of exercise by playing has the sanction of acquired facts. It was the only children's gymnastics at the beginning of this century, and even now some nations have no other settled method of physical exercise. The English have never taken to gymnastics with apparatus; and the Belgians, after having tried it, are abandoning it and returning to play. No one can question the excellence of the results of the English method; the vigor and endurance of English youth are universally recognized, and their school-games constitute their whole gymnastics.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

THE subject of mental overwork was discussed in the Anthropological Society some time ago, in the light of the recorded observations of school-teachers. Weariness of mind, it was said, is marked by irritability, as manifested in sleeplessness and in nervous laughter; and by fatigue, exhibiting itself in sleepiness and incapacity for task-work. Headache suggests overstrain in study, defective ventilation, or, perhaps, a too sparing diet. Sometimes the perception of particular colors is obliterated for a time, and this may suggest an explanation of some forms of color-blindness. In some cases a form of somnambulism was originated.

THE POLITICAL CONTROL OF RAILWAYS: IS IT CONFISCATION?

By APPLETON MORGAN.

IT may be doubted whether the non-enforcement of the Interstate Commerce law, however fortunate for the railway companies, is not an unmixed calamity for the country. For, if the shortest way to abolish a bad law is to vigorously enforce it, the danger is that the slumber of so un-American and unconstitutional a measure will lead, by mere lapse of time, to its becoming an apparent part of our governmental policy, and so, at the last, all the more awkward to be got rid of. Had the principle of the interstate commerce law been applied by Congress to any other industry or industries than that of transportation, it is exceedingly doubtful if the industries so paternally favored would have acquiesced as patiently and good-naturedly as have the railway companies. But there is no knowing how far the precedent may be pushed. So long as consumers outnumber producers and purchasers outnumber sellers, if the temptation should ever arise for the consumers and purchasers to decree the price at which producers shall produce and sellers sell (that is to say, for the majority to confiscate the property of the minority), certainly the principle of the interstate commerce law could be cited in favor of such a confiscation. (The railway companies in at least one of our Western States have been enjoying this sort of confiscation, under what has been called "the Iowa idea," viz., that "railways can take care of themselves," in abject silence now for many years, thus affording another cumulative precedent for a possible majority programme.)

When Judge Nelson set aside the verdict of a jury, on the ground that it "took thirteen men to rob a corporation in that court," he was entertaining a sort of judicial cognizance of that disposition on the part of the average "jury of the vicinage" toward railway companies which, unchecked, would quite speedily make railway operating a very costly amusement for investors. But the utmost juries can do toward robbing or crippling railway corporations is a very small matter compared with this latest movement of political forces, to confiscate—under the pretext of caring for—the interests of the people, of which the laws we are about to glance at are the outcome. Every sovereign State in this Union has constituted a "Board of Railway Commissioners," which is, and must be, political in its character, and so shifting with the politics of the State and of its Executive; and to these boards is relegated the whole procedure of the railway companies,

and upon them is made incumbent and peremptory the duty of "regulating" the affairs of the railways. What is, and what must be, the result? The average politician knows fully as little or as much about railway management as he does about photographing the moon or applying the solar spectrum; yet, once upon a board of railway commissioners, he is required to excogitate and frame rules for an industry which not only supplies the financial arteries of a continent, but holds the lives as well as the credits of its citizens dependent upon the click of a telegraph or the angle of a semaphore—an industry which adjusts at once the most volatile and the most ponderous forces of nature to every necessary or luxurious service of our people! And, since thirty-eight boards of these accomplished commissioners were not enough, the General Government has kindly added another—not to regulate or supervise these thirty-eight, but to act in independent chaos to their tergiversations, and to contribute to the general value of their independent conclusions, ordinances, rules, and codes. What must, or rather what must not, be the result, when the country asks, as it appears to be now asking, to be furnished with railway experts and traffic accountants at the polls?

When the socialist programme shall be carried out to its full, it is understood that there is to be no inequality between the capitalist and the tramp. This equality, however, need not wait the perfection of that programme. It can be achieved to-day by two extremely simple methods. Either the tramp can go to work, earn money, economize, and become a capitalist, or the capitalist can divide with the tramp. But while the capitalist, for his part, opposes no objection to the first plan, the latter appears to be the only one the tramp will listen to. Both seem to be at present in abeyance. But, as to those aggregations of operated capital we call railway companies, I am not so sure but that the entering wedge for the second plan has been inserted. Let us see.

The interstate commerce act, with its administrative commission, does its fine work by forbidding two things; namely, "pools" and "discriminations." The State acts, with their administrative boards, also deny these two, but add edicts as to almost everything else: charges for service, size and cost of equipments, ratio of salaries, etc., to be charged, made or paid by their pupils the railway companies. I shall attempt in this paper to show that all this tutelage can have but one logical and political outcome; and that outcome—confiscation! The terminal sounds harsh, extravagant, impossible! But let us lead up to it and see if it be either.

The word "discrimination" means almost everything, and can hardly be limited to anything definitive. If I invite one of my

friends to dinner, I discriminate in his favor against any friend whom I do not invite to dinner. If, in company with several millions of my fellow-citizens, I vote for President Harrison, and President Harrison invites a man who has voted for him to dinner, and does not invite me, he discriminates against me—me, from whom his charter as President has come equally as from my fellow-citizen who dines at the White House when I do not. But, conceding, in the case of a railway company, that discrimination, otherwise innocent, may work hardship—and also conceding the jurisdiction of the people over the railway company it has chartered, to prevent hardship to themselves—have this Interstate Commission and these boards legislated against the hardship? Have they not rather expended their legislation against the thing which may or may not be a hardship, according to circumstances, and in so doing increased the hardship, to their own damage and expense, rather than ameliorated it?

I. THE INTERSTATE ACT.—This act directs itself to forbid (*a*) discriminations and (*b*) pools. Now, an edict against either of these might mean something—might even, if qualified, be productive of good. But an edict against both is really nothing—can not possibly amount to anything—except either an increased hardship to all parties concerned, or else the usual affirmative to which two negatives invariably amount. If railway companies can neither discriminate nor come together for consultation and abolishment of discriminations, what is the result? Merely the result which would follow an attempt to abolish the mice in a pantry by first abolishing the cat which had been put into the pantry to abolish the mice.

The only possible pretext on which Congress, acting for the people, could abolish pools, was that a pool was a "corner" in transportation, by which two or more competing lines proposed to raise the carrying-tariff in their section of country. But, as a matter of fact, the pooling system was a contrivance *to reduce jointly* the carrying-tariff in territory where two or more lines served, and that pooling system practically and actually did reduce the tariffs to shippers. This I have demonstrated and proved by figures already in the pages of "The Popular Science Monthly."* "The pool" proper had nothing to do with this reduction, except that it controlled the division of tariff receipts between the treasuries of the two or more pooling roads by a process of exact and expert differentiation in which a question of distance transported was only the very minor factor employed; such items as the cost of stopping, loading, or siding, or returning a freight-car empty to its owner, station expenses, repairs to track-way, rolling-stock, clerk-hire, improbability of find-

* June, 1887, p. 147.

ing load at small stations, fuel, grade, volume of traffic, cost of domestic goods at terminals as against direct importations from convenient ports of entry, rates of exchange, markets, first cost of plant, location and construction of track—and a few thousand other such items (an array which tends to make the practical railroad man's head swim by the very enumeration, but which are of no consequence whatever—are but the crackling of thorns under a pot—to the politician who represents his "district" in the Legislature or in the lobby), went into the consideration of the question of division of tariff receipts before the pool commissioner. (We may pause to ask, if reasonable rates were charged the public for transportation by a pooling road, what concern was it of the public's how the rates were divided when received? If I go into Delmonico's and pay a dollar for my luncheon, and on the way out stop at the cigar-stand and pay a quarter of a dollar for a cigar, what business is it of mine how the two cashiers I have paid equate the two payments—whether they turn them in as cash or merchandise, or itemized, or as items, or as receipts?) The public were not interested in the book-keeping methods of our railway companies. They were, however, very deeply interested in the cheapening of railway tariffs; and when, on the abolition of the pool, rate wars began again and tariffs advanced until—up to the first day of July the people had paid about $60,000,000 to the companies in excess of railway tariffs of the year before the interstate commerce law began to protect them against railway despotism—the people then began to look about for a possible cause. That cause was not far to seek. The railways, unable to meet and settle their differences in convention, where each should discuss its own problems and average them with the others, were forced to prepare each its own schedules independently. These separate schedule-tariffs were enforced and collected, and the Interstate Commerce Commission was able to say triumphantly, in its first annual report, that the act had operated directly to increase railroad earnings* in eight months from the approval of the act.

Why should it not have so operated? It could not have operated otherwise. That a carrier's rates should be "reasonable" had and has been common law for four hundred years, and by repronouncing it the interstate commerce law added nothing to its force. But to be "reasonable" a carrier's rate must not be unfair to either party. If it is unfair to the carrier—if it demands that he perform services for less by way of remuneration than it costs him to do the work—then the rate is certainly not "reasonable." And so it comes about that, by declaring in one paragraph that rates should be "reasonable" and in another that there should be

* Official edition, p. 41.

no "pool," the act did not prevent but rather conserved unreasonableness; for—since a "pool" was not a "corner," but an attempt, by co-operation and convention of railway companies, to make rates "reasonable"—a law which does not give the railways a schedule itself, and forbids them to come together to make one, simply means that each company shall make its rates without consulting anybody but themselves: must work in the dark, independent of any considerations except its own local, presumptive, or past experiences, frictions, and financial difficulties. Railways must not only make bricks without straw, but make them at their peril; for if, upon being made, these rates prove to be discriminate—that is not absolutely perfect and uniform between individuals—then the Interstate Commerce Commission (and nobody knows when it may wake up and commence operations) can send the officers to jail and hold the road in breach of law. Clearly the only safe alternative for the road is either to wind up business at once, or do business at a loss and pass a dividend to get even, thereby placing its securities at the mercy of the wrecker and the stock-jobber!

It follows from the above that the interstate commerce law operates, if operated at all, to create rather than to abolish "discrimination." But let us be a little more explicit. If all the people in the United States were shippers over one railway, a law that no one person shall be given a better or worse rate than another might possibly prevent injustice (though, unless it also provided that the volume of business or the length of the haul be taken into account, it may well enough be questioned whether it would or not). Even the non-railway intellect must absorb such self-evident propositions as that it costs as much to load, unload, or stop a car that has run two miles as one that has run two hundred; that if the car must be returned without a load, it has not earned as much as if it had found a load back; that a long haul, with but one loading and one unloading, one stoppage, and a return cargo for the car, ought reasonably to be done for less than a short haul involving quite as much handling without a return load, and that a railroad company ought in all fairness to be allowed to give the shipper the benefit of the decreased expense to the company. But the interstate commerce law peremptorily tells the railroad company that it must not give this benefit to the shipper, under the pains and penalties of fine and imprisonment, in its pleasure, for contempt of court. But let us admit, for argument's sake, that a law providing that no shipper shall be charged more per pound than any other would prevent discrimination if all the shippers of freight in the United States shipped over a single road. Clearly, if they shipped, as these shippers do, not over one, but over some five hundred different

roads, such a law would not prevent discrimination, but actually compel it. Let us say that a shipper in New York desires to send goods all-rail to Chicago, and that he has a choice of three all-rail routes (as a matter of fact he has a choice of thirteen, but we will use the lesser number). One of these all-rail routes runs by a right of way laid out some forty years ago, under the then existing systems of engineering, climbs heavy grades, crosses the Alleghany Mountains twice, and makes the trip about one thousand miles. A second, laid out some twenty years later, has better grades, but crosses the mountains only once. A third runs by almost a series of bee-lines, has a grade nowhere exceeding one per cent, and was constructed and capitalized at less than a fourth part of the accumulated capital and indebtedness of the other two. Now, left to themselves, can these three railways, with different amounts of fixed charges, interest, dividends, and operating expenses to pay annually, carry for the same tariffs at the same rates to the same points, and all pay expenses? Ought they, in justice to the investors, whose money built them (and who are portions of the people quite as much as are the shippers over the line or the members of State Legislatures), to make the same rates for equivalent services? From the standpoint of the gentleman who believes that railways should meet their fixed charges, and all other expenses—should pay their bills, that is to say, like ordinary mortals!—from this standpoint, I say, it would seem as if a difference in rates to Chicago, over these three all-rail lines, was inevitable. And so it was, up to the invention of the pooling system: each road made its own tariff-schedules independently, and naturally the tariff of each was different from that of the others. But, without supposing that they were committing a crime, and as yet unconvinced of sin, these three railways, let us say, came together, and determined to make a single rate to Chicago for all business received by each of the three lines; these receipts to be pooled and divided something upon the basis outlined above. Even had they proceeded upon a basis of the single actual receipts to each for solicited business, there could be no difference to the public either way; but they chose to consider the most complicated problem of a single tariff divided upon the items of expenditure, outlay, and cost described above. What resulted? Simply that there was (as the interstate commerce law says there shall be) *no discrimination.* But when the interstate commerce law, while keeping the word of promise to the ear by saying there should be *no discrimination,* broke it to the hope by saying there should be *no pool,* what resulted? Why, in the case of these three roads, a discrimination in favor of one third against two thirds! For, when each of these three roads makes its own tariff, of course, the road having the smallest fixed charges to pay makes

the lowest rates. The dwellers along that line have the advantage of these low rates to which, of the other two railways, only one can approximate; while the third line must either go to the other extreme, or defraud the holders of its securities. Not to dilate unnecessarily upon the situation, the reader can see at once that prohibiting a long and short haul discrimination upon any one railway really increases discrimination to the whole people; and that, on the whole, the pooling system was the fairest system for the whole people, as well as for the railways, that could have been devised, for both shipper and investor: for the shipper, since it gave him all the benefits of cheap freights; and for the investor in railways, because it secured to the railway built under heavy capitalization, and laboring beneath huge operating expenses (but serving a territory as entitled as any other, *per se*, to transportation facilities), a fair return upon the wealth that had been lavished to build it.

The theory of the interstate commerce law was borrowed from Europe—from England and Germany; and, although there may be those who admit that whatever is good enough for England or Germany is good enough for the United States, it ought not to be forgotten that neither of these eminent nations possess railroad systems at all analogous to our own, or in the operation of which anything like the same problems or conditions arise. The existence of two, let alone five or six, parallel lines is not only unknown, but impossible, in either of those countries; and yet the promoters of the interstate commerce act in Congress, and apologists for it ever since, pointed and still point with pride to the fact that the provisions of the act can not be onerous, because their operation has been tested, without annihilating the railway interest, in England and in Germany!* As a matter of fact, there are several hundred other practical discrepancies between American and foreign railways; but it would swell this paper unduly to discuss them here, and the above-mentioned alone is enough to dispense with the plea that the interstate commerce act is a good one for this people because its tenor has worked well across the ocean. I might add, however, that, despotic as is the German Government—the government of blood and iron—over all private enterprise, at any rate it has never yet discriminated against the enterprise of its own subjects in favor of the schemes of national rivals. Doubtless it is unfair to charge to the framers of the interstate commerce act a desire to benefit Canadian railroads (notably the Canadian Pacific Railroad) at the expense of our own railways. That such has been the paramount unpatriotic effect of

* "Much of the language used in the most important sections" (in the act) "has a settled meaning, having been judicially construed either in this country or in England."—*Senator Cullom's Springfield speech.*

that act is merely a proof that its framers overlooked the consequences of their hastily advised and badly considered procedure; were betrayed into regarding the popular hostility to railways from a political rather than from a patriotic standpoint, and so into the folly of precipitating a hard and fast rule upon an industry as delicate in its adjustments as it is massive in its ramifications; an industry of whose operations no single act or necessity of our sixty millions of people is independent; a rule so hard and so fast that were it attempted to be enforced (as a possible anarchist or socialist administration might see fit to enforce it) it would plunge the entire commerce and credit of this continent into chaos in twenty-four hours! To express the consequences, were it once literally carried into effect, the performances of the typical bull in a china-shop would be a notoriously inadequate figure (removal of a cataract from a human eye with a butcher's cleaver, or oiling the works of a Jurgensen watch by boiling it in axle-grease, might possibly better express the summary viciousness of the process).

So much for the Federal railway statute. As to the railway statistics of the several States, they have been comparatively innocuous—not so much from desuetude as from the general incapacity of their administrators. On the whole, their operation has been more largely comedy than tragedy—as where the Board of Railway Commissioners of one State have enacted that upper berths in railway-sleepers shall not be made up before the lower ones;* that of another have found that if a railway-bridge had fallen before a train reached it, instead of after the train had passed upon it, it would have been safer for the train;† or that if a bridge had been known to be unsafe, a train would not have been run upon it at all.‡ But that even State railway laws may be dangerous, I may note two very recent examples. The Board of Railway Commissioners of Mississippi have recently been given increased powers; have now authority to specify the description and size of station-houses which railway companies must build, and the point and location at which they must stand; to require the building of union passenger depots where two or more railroads connect, and to allot expenses of the same between the two or more companies compelled to pay for erecting them. This, in all conscience, seems to be going far enough. But the Iowa Board of Railroad Commissioners went still further, and not only regulated the question of accommodations, but actually furnished the railway companies *with a schedule of the prices at which they must do the business* which the people bring to them: that is to say—for the terms are convertible—the prices which the people shall be

* Minnesota Board of Commissioners. † Illinois Board of Commissioners.

‡ Massachusetts Board of Commissioners.

allowed to pay the railways! It is precisely as if the Legislature of New York should provide upon what quality of paper, with what size of type, or color of ink "The Popular Science Monthly" should be printed and furnished to its readers, the Legislature meanwhile not assuming any of the expenses or responsibilities of the publication, paying any losses, troubling itself about any of the risks incident thereto, or even inquiring into the facts of its circulation, cost of manufacture, or pay-roll: for that the Mississippi board even made the slightest effort to inquire—or heard any testimony as to—the volume of business, fixed charges, earnings or operating expenses of the companies to whom it dictated disbursements, there never was the slightest idea or claim anywhere. Indeed, it was the very gist of the ruling in some of those wonderful "Granger" cases (so called), that any such items as the above were "too remote"; the railway company must do business under schedules furnished by the shippers in Legislature assembled. Would a single powerless individual on this continent submit to such legislation as that?

It is rather remarkable that, though the Interstate Commerce Commission has existed almost two years at Washington, the only decisions at all affecting the general railway situation should come from Federal judges holding remote circuits, and that both of these should contravene and ignore an extraordinary tribunal created by Congress to specially oversee railways, sitting at the capital itself. The first of these declared that a railroad company might remain upon the earth, even though it was compelled to charge more for a short than for a long haul;* while the other enjoins the Iowa Board of Railway Commissioners from dictating the tariffs at which certain trunk lines shall do business within the borders of that State.† Of this latter decision let us hope that it will do something to relieve the delicate adjustments of our railway systems from the lash of ward politics and unenlightened demagogy.

Of all the popular fallacies ever discussed, it seems to me that the one which invokes popular prejudice against railway companies has the least actual basis of merit to stand upon. As a positive fact, the railway is not only chartered by the people, but can only be operated for the people's convenience. In "The Popular Science Monthly" for May, 1888, I had occasion to allude to a certain voluminous denunciation of incorporated industries as rehabilitating the effete institution of feudalism, which appeared to be principally based upon the supposition that *feudalism* and *despotism* were convertible terms. As a matter of fact, feudalism was not by any manner of means a despotism *per se*, even though

* Deady, J., United States Circuit Court for Oregon.

† Brewer, J., central division of Southern District of Iowa.

obtaining at a date when all government was more or less despotic (and generally more than less). Neither did a feudal system ever decree the prices at which its vassals should yield their labor. Supposing a railway company to have been in operation in the days of feudal systems, can any one imagine a law compelling it to make charges irrespective of the services it rendered? And yet, in a late session of the House of Representatives at Washington, a bill was, I am informed, introduced to forbid a railway company from carrying oil in tanks at lesser rates than it charged for carrying oil in barrels! (It is immaterial that oil in tanks can be carried with very little handling, and at an expense of labor and material very little over that required to run empty cars, while to transport it in barrels requires much handling, care, and watchfulness. Nothing in the way of detail, it appears, is material when politicians assume to legislate concerning railway companies.) Indeed, our railway companies might well clamor for and welcome a return to feudal systems, if they consulted their own convenience—to say nothing of their fixed charges! Nor would a return be such a bad thing for the anarchist or the socialist from his own standpoint. For, under feudalism, the subject was not touched by the crown-taxes—the taxes for revenue, for war-making, for internal protection. The fathers of our common law, in tracing the origin of property to "title by occupancy" to the garden of Eden (which Adam, at least until different arrangements were made, owned because he occupied it)—to the times when King Ahab, despot as he was, dared not help himself to Naboth's vineyard until, by ruse or device, he had divested Naboth's title—never denied the general proprietary title to the earth's surface which Mr. Henry George has selected as the proper one. They simply set it aside as inconvenient. But, whatever elemental title human beings may have to the use of the earth's surface as human beings, the railway company holds its title to its right of way by both alienation and use. It has purchased, but can only enjoy, so long as it serves the public. It is a public trust for a public convenience only. From the moment it ceases to serve the public and the public convenience, its franchises, its titles, its real estates lapse; and every court in Christendom has so decreed and maintained. If Mr. George's system of common proprietorship in real property were law to-day, he could not divest a railway company so long as it performed its functions. And yet it is over this industry, chartered only for the public facility—and simply because under and by reason of the immense convenience of that facility it requires enormous capitalizations and creates immense debts—that the politician squats, and the anarchist howls, and the communist grinds his teeth.

Altogether, the railroad company seems to be in the position of Mr. Dow's Calvinist:

> "You can and you can't,
> You will and you won't;
> You'll be damned if you do,
> And be damned if you don't!"

Twoscore of boards, framed by consent of local politicians, shout: "You railways must operate your trains. You must incur such bills as we Railway and Interstate Commissioners impose upon you, and do just as we say in everything; but you can not collect for your services the wherewithal to pay bills, except at such figures as we see fit to permit you to make. We know nothing about railroading. We are only Republicans, or Democrats, or Prohibitionists, or Women's-Righters. But do as we say; and if, in the doing of it, you kill anybody, or maim anybody, or if we hear of any defaults in payment of fixed charges, look not to us for loving-kindness!" This was Portia's idea of mercy to poor Shylock. And let us admit, for argument's sake (or concede it as certain, for that matter), that the railway company is a Shylock, compelled by law to exact the last penny to which it is entitled. "Cut out your pound of flesh," says Portia; "the court awards it and the law doth give it. But if, in the cutting, you take more or less, by the estimation of a single hair, than just one pound, then your goods are confiscate and your life itself is forfeit to the state" —and in so saying, the divine Portia (who had already admitted that the Jew asked nothing but justice, and was entitled to judgment at every point in his favor) was a by no means unfair prototype of the modern American Legislature, which first charters railway companies to exercise certain and stated functions, and then exercises them itself, leaving to the unhappy railway companies nothing but the responsibility and the punishment for its own blunders. Under the circumstances, is it to be wondered at that, very recently, a certain worm did, in some sort, turn?—that a certain railway company in the distant West, on being commanded by the Iowa Board of Railway Commissioners to turn in to them a statement of the value of its plant, replied that its plant was worth considerably less than before the commissioners began to make rules and regulations; that it would continue to depreciate as long as the commissioners kept on making them; that any estimate as to the aforesaid value would be mere guess-work; and that the only certainty possible in the matter was that enough rules and regulations from the honorable commissioners would ultimately deprive railway plants in their jurisdiction of any value whatever!

There are a few things left which a railway company may do. It may, by a late decision of the Interstate Commission, issue

as many "passes" as it pleases, provided they are not used.* But no railway company is to be allowed to escape an interstate character from any such pretext as that it operates entirely within a single State—the commission affirmatively holding that if any parcel, the ultimate destination of which is outside of the State in which it is shipped, is carried by a local road, that local road at once, and by the act of carrying that parcel, becomes an interstate railway.† This is Lord Coke's celebrated maxim, that it is the part of a good judge to enlarge his jurisdiction—with a vengeance!

GIANT REPTILES OF A PAST AGE.

By OTTO MEYER, Ph. D.

INDIANS of to-day, who are well acquainted with the history of their race, may often think with melancholy of the olden times, when their forefathers were the only masters of the country. Numerous and powerful tribes occupied the vast territory between two oceans, some hunting the deer in the forests of the East, others ruling supreme in the plains and mountains of the West. The white man was fighting hard for his existence in small settlements along the coast. But, whatever perfection in warfare and in the use of their weapons the Indians had acquired by the experience and practice of many generations, it was useless against the rising foe, who possessed and introduced entirely new arms and methods. And what is the result to-day? The majority of the tribes, and among them the most powerful ones, have been extinguished entirely; while others, sadly diminished in numbers, linger here and there, and the pale-face is met everywhere.

The same feelings of melancholy must enter the mind of an alligator of geological education, when, during a *siesta* in the sun, he thinks of the good old Mesozoic times and compares them with the pitiable present. "How beautiful were the Triassic and Jurassic periods, when numerous and powerful orders of reptiles were masters of the earth, when mosasaurus and other kings of the water were hunting the animals of the ocean, when gigantic dinosaurs reigned on the land, and pterodactyls populated the air! That parvenu, the mammal, was existing only in small species and struggling for an existence. But, alas! how is it now? Of

* Matter of Burlington and Missouri River Railway Company. It is remarkable that, of the millions of passes which four hundred railway companies find it necessary to issue in the course of their operations, the only case in which a pass has attracted the attention of the commission is one where the pass was never lifted.

† Bragg, J. Matter of Johnstown and Gloversville Railway Company, "First Annual Report of Interstate Commerce Commission," p. 126.

our nine orders of reptiles five have disappeared entirely, among them just the most powerful ones, and only four are still in existence. Lizards, turtles, snakes, and we crocodiles have found refuge wherever we could, and mammals are met everywhere. And how did they succeed in thus becoming rulers of the earth? Simply by introducing new-fashioned arms and methods, such as warm blood and developed brains; and the most thickened bone plates and largest spines of our ancestors proved to be useless in the new kind of warfare." So *Alligator Mississippiensis* may meditate, and as a furious Apache Indian surprises and kills a lonely white squatter, so the alligator may rush upon and seize a strolling mammalian dog or pig of the nearest plantation.

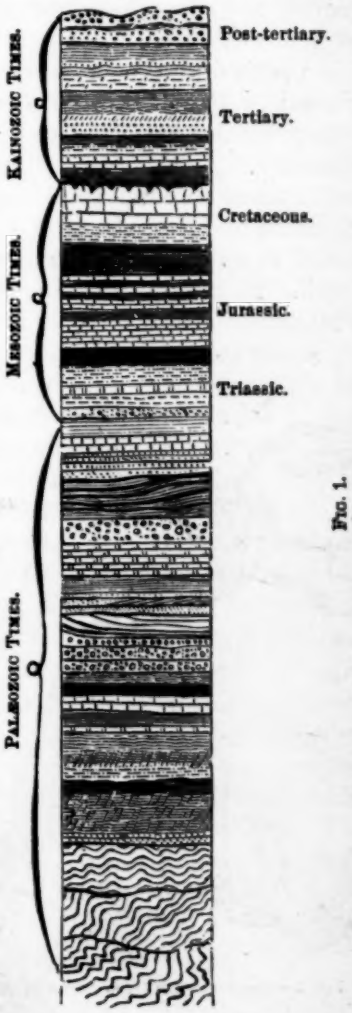


Fig. 1.

The dinosaurs, one of the mentioned extinct orders of reptiles, were animals living on the land, some of them peaceably feeding on plants, etc.; others were dangerous carnivores. In form and size they showed differences as considerable as are presented among the existing mammals by the elephant and the mouse. While the smallest known dinosaurs were not larger than a fox, some of them attained a size which is almost fabulous, and a giraffe or an elephant would appear as a dwarf in comparison with these monsters. We may obtain a general idea of many dinosaurs if we imagine an animal like a huge crocodile, but with a smaller head, a longer neck, and posterior legs which are larger than the fore-legs. These larger posterior limbs, in connection with the long strong tail, gave to these animals somewhat the appearance of a kangaroo. Like this latter quadruped, they were occasionally sitting on the hind-legs and the tail, and some of them were probably also walking or hopping on their posterior legs. Instead of starting from a crocodile, we might therefore say: Let us imagine a huge kangaroo, where the difference between fore and hind legs,

however, is not so great, and then let us transfer this into the reptilian system. For, while a kangaroo is a warm-blooded mammal, covered with hair, the dinosaurs were cold-blooded, scaly reptiles. The anatomy of the dinosaurs resembles that of the lizards and crocodiles, but in many respects it reminds us of the skeleton of birds. These bird-like features appear especially in the pelvis and the posterior legs, and are so striking that some scientists believe that birds are the descendants of dinosaurs; others think that birds and dinosaurs originated from a common ancestor. The close relationship of these two classes of animals will appear to us more plausible if we remember the fact that the birds of the Jurassic and Cretaceous periods resembled reptiles much more than they do now—for instance, in their possession of teeth. This may be said of dinosaurs in general, and we may now contemplate some of their known representatives.

If we enter the Museum of the Academy of Natural Sciences in Philadelphia, the first thing that attracts our eye is an enormous skeleton found at the left side of the entrance. It represents an animal seventeen feet high, and measuring from head to tail twenty-four feet. It is mounted so that it stands on its hind-legs and is supported by its strong and long tail, while the short anterior limbs rest upon a structure purporting to be a reproduction of a tree of past periods. If we examine the skeleton more closely, we find that only a few bones of the hind-legs and the tail are naturally found fossils, while all the other bones are artificial casts. But most of them are exact representations of the original fossil bones, which are kept under glass for the sake of better preservation. They were found in 1858 in the cretaceous formation of New Jersey, and the animal has been described under the name of hadrosaurus. An exact imitation of this skeleton exists also in the National Museum at Washington.

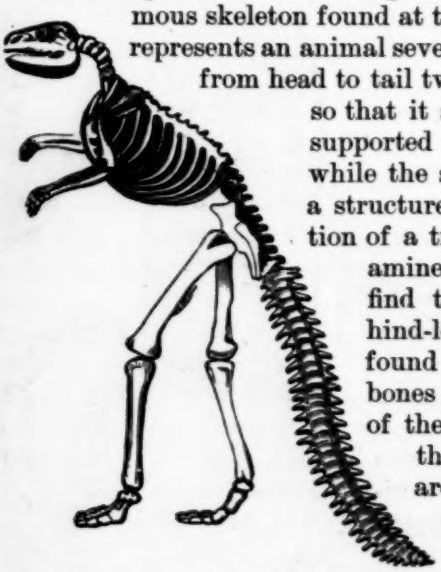


FIG. 2.—HADROSAURUS (restoration by Hawkins).

The hadrosaurus is as yet the only complete mounted dinosaur in America, and it must not be forgotten that some parts of this skeleton were not found, but for the sake of completeness were formed in analogy to the others. In Europe they have been more fortunate in this respect. In the Royal Museum, at Brussels, in Belgium, there is the mounted skeleton of a similar dinosaur, the

anatomy of which is almost as well known as that of a dog or a cat. This animal, the iguanodon, in the way it is mounted, reaches a height of about fourteen feet, and a length of nearly thirty feet. It also stands on the hind-legs, and is supported by the strong tail, which constitutes about a third of the whole length. The neck is erect, and the head horizontal, as if the animal were gazing forward. The short anterior limbs, somewhat bent, are hanging down. The hind-foot is composed of three strong toes armed with claws. The fore-feet have a long and strong spine where we have the thumb. The name of the animal has been chosen on account of its teeth, which resemble remarkably those of the Brazilian lizard, iguana, and indicate that the iguanodon was no carnivore, but a herbivorous animal. It is thought that this animal lived in swamps or on the banks of rivers. It is further believed that it walked on its hind-legs, and that it treated its assailants in the way of a bear, by embracing them with its short and strong fore-legs, and piercing them by the dagger-like spines of the fore-feet.

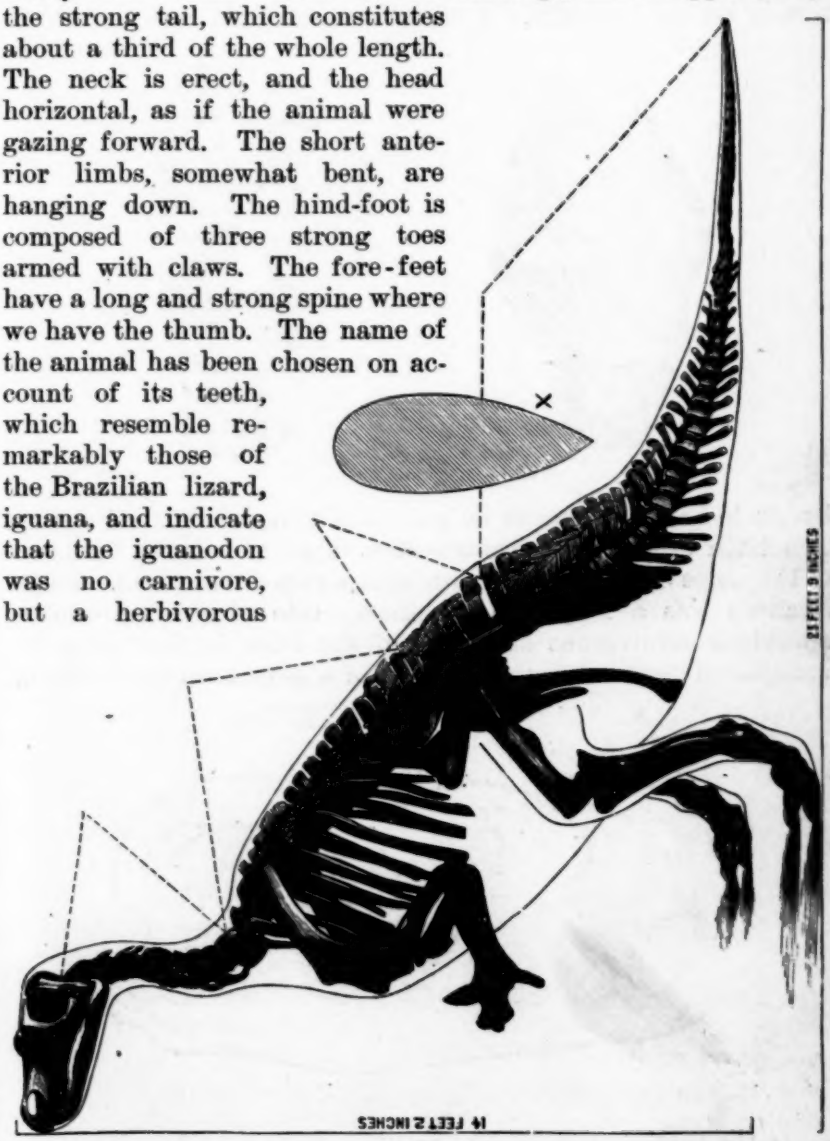


FIG. 3.—IGUANODON (restored and mounted by M. L. F. Depauw).

Who were these assailants? Probably also dinosaurs belonging to the carnivorous branch of this order. One of the best known of them is the megalosaurus, an animal of about the same size and way of living as the iguanodon, marching or wading mostly on its hind-legs. A carnivorous animal is characterized

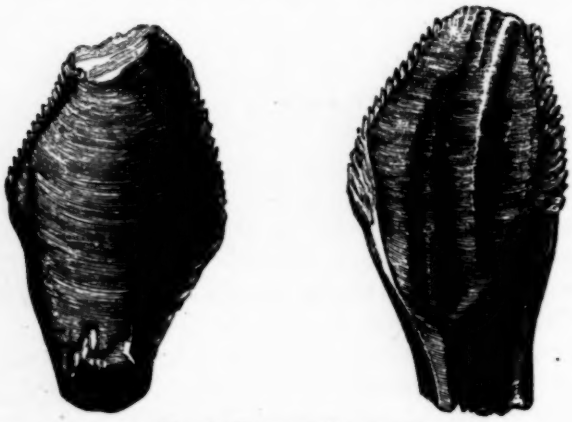


FIG. 4.—TEETH OF IGUANODON.

by its teeth, which must be apt to seize and lacerate its prey. The teeth of megalosaurus were few in number, large, flattened, of the shape of a saber, and with sharp, crenulated edges. Megalosaurus was a European dinosaur. One of the best-known American carnivorous dinosaurs of the Jurassic formation has been called ceratosaurus, on account of a large horn on the skull.

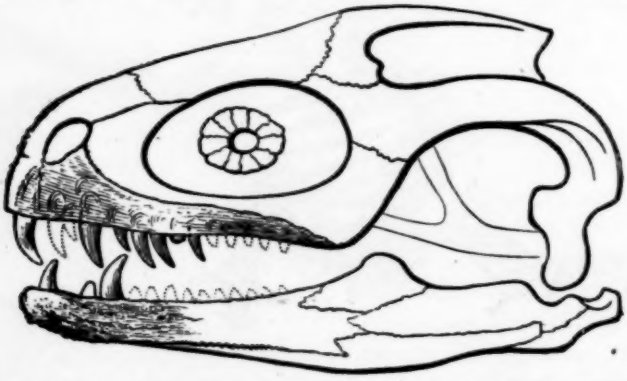


FIG. 5.—HEAD OF MEGALOSAURUS, one tenth natural size (restored by Phillips).

If the reptiles mentioned heretofore, with a length of twenty-five to thirty feet, must be called beasts of quite a respectable size, they were by no means the giants of their order. The largest known dinosaurs have been found in the Jurassic formation of the western slope of the Rocky Mountains, in Colorado and Wyoming. In the A Museum of Yale College, in New Haven, there are

the vertebræ, limb-bones, etc., of the brontosaurus, which have been found in these beds. If, according to these remains, we make a restoration of the whole skeleton, the result is an animal of about sixty feet in length. But this is not all. The bone of the upper hind-leg, the femur, of the brontosaurus is smaller than six feet.

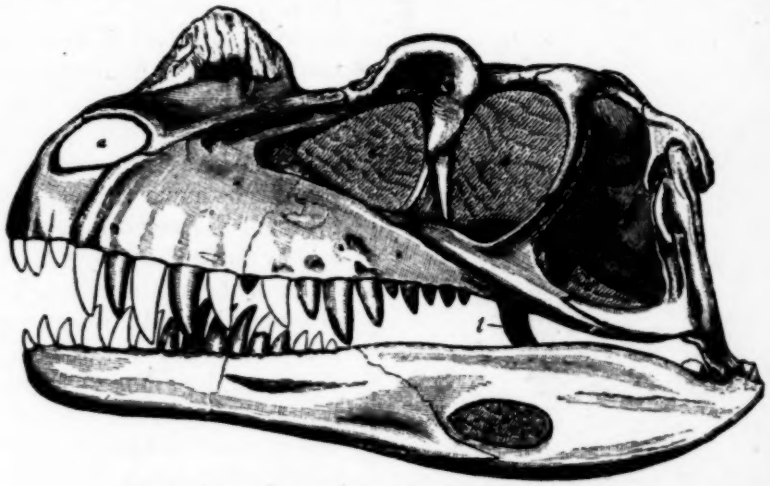


FIG. 6.—SKULL OF CERATOSAURUS, one seventh natural size.

But in the same museum there is, besides other remains, the femur of a very similar dinosaur, found in the same beds, which is about eight feet long, and belonged to an animal the length of which has been estimated at from eighty to a hundred feet. It has been called atlantosaurus, on account of its size. This atlantosaurus must have been a beast able to sweep down an elephant with a stroke of its tail as a crocodile would a dog. Of all the known land-animals, living or fossil ones, it is the largest, and it is probable that Nature reached a limit in producing land-animals of this size.

If we compare with the atlantosaurus the smallest known dinosaurs, we find an enormous difference. In the lithographic limestones of Solenhofen, in Bavaria, which have yielded so many well-preserved and interesting animals of the Jurassic formation, a dinosaur has also been found. This animal, called compsognathus, had posterior legs which were much longer than the anterior limbs. It therefore probably walked or hopped on its hind-legs like a kangaroo or a bird, and altogether, with its long neck and small head, must have resembled a good deal the birds of the same period.

The name of dinosaurs means terrible saurians (δεινός, *terrible*); and, indeed, the aspect of animals like the atlantosaurus and others was probably such as to justify this name. One of the oddest-looking creatures of this order must have been an animal called

stegosaurus, the remains of which have also been found in the Western Jurassic and are preserved at the Yale College Museum. It was about twenty-five feet long. Its skull contained a brain which is comparatively the smallest brain which we know in any quadruped. It was, indeed, so small that it was probably not sufficient to control and direct all the nerves and muscles of the gigantic body. At any rate, we find in the stegosaurus that the vertebræ of the sacrum contain a cavity formed by an enlargement of the spinal canal. This chamber is ovate in form, and resembles the brain-case in the skull, but it is very much larger, being at least ten times the size of the cavity of the brain. Although we find in some animals a swelling of the spinal cord at the same place, there is nothing known which might be put beside the stegosaurus in this respect, and it is difficult to object if somebody claims that the animal possessed two brains —one in his skull and the other in his sacrum. The stegosaurus was, according to Marsh, protected and armed in the following way: At the region of the throat and lower part of the neck there were small dermal plates in the thick skin, which were regularly arranged. The upper part of the neck was shielded by larger plates of the same kind, which were placed in pairs on each side. These plates of bone increased in size posteriorly, and covered the back. From the sacrum

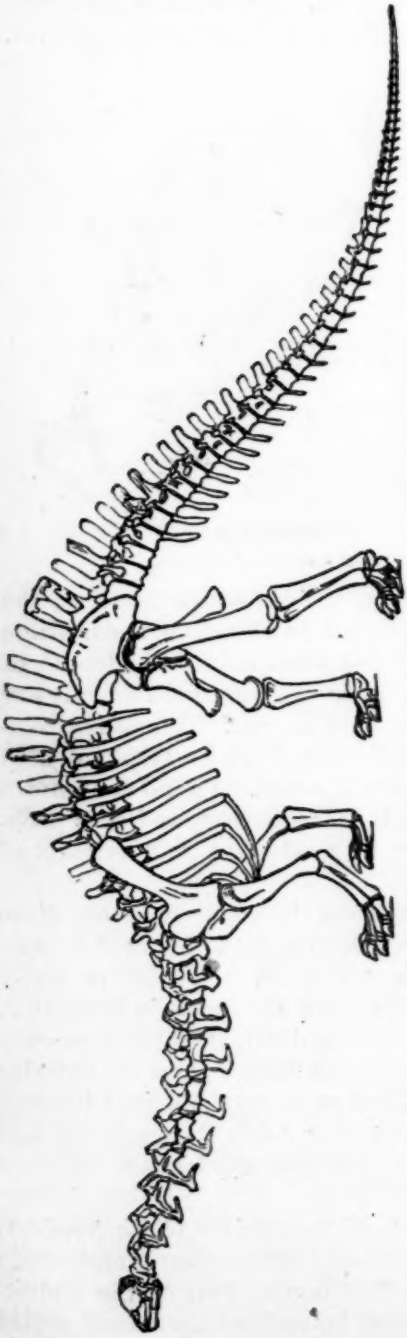


FIG. 7.—BRONTOSAURUS, one ninetieth natural size (restoration by Marsh).

to the middle of the tail there was only one row of large scutes. At the end of the tail there were, as weapons of offense, several thick spines, about a foot long, so that a stroke of this tail must have been telling in its effects.

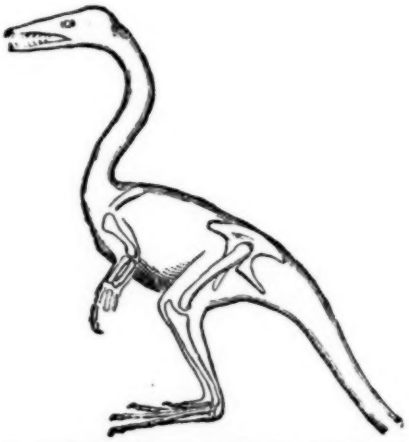


FIG. 8.—COMPSOGNATHUS (restoration by Huxley).

FIG. 9.—FOOT-PRINT OF BRONTOZOUM, one eighth natural size (after Hitchcock).

We have now made the acquaintance of several dinosaurs, yet they are by no means all the members of this numerous order, upon which already a whole literature has been published. Some of them are known only by their foot-prints. The Triassic sandstone of the Connecticut Valley contains numerous impressions of five-, four-, and three-toed dinosaurs, which at first were considered as the foot-prints of large birds. They were made when these animals walked on the muddy shores of the Triassic ocean. The collections of Amherst and Yale College contain each several thousands of such impressions—a fact that gives some idea of the abundance of reptilian life on the continent at that time. Also, in Europe, we find that reptiles, and among them especially dinosaurs, are the most numerous and dominating class of the Mesozoic times—that is, during the Trias, Jura, and Cretaceous; so that these times are often called the age of reptiles. At the end of the Cretaceous period, however, the reptiles decreased, and the dinosaurs became entirely extinct—at least, we do not know of any Tertiary dinosaur, and none exists at present.

Our knowledge of these remarkable animals is a comparatively recent one; of them almost nothing was known thirty years ago, but since then discoveries have followed each other in rapid succession, and every year contributes new data. It is especially to three American scientists that we owe most of our knowledge about dinosaurs; they are Prof. Joseph Leidy and Prof. E. D. Cope, in Philadelphia, and Prof. O. C. Marsh, in New Haven.

THE YEZIDEES, OR DEVIL-WORSHIPERS.

By DR. L. E. BROWSKI.

THE Yezidees, sometimes called "Devil-worshipers," are one of the half-dozen curious and interesting sects outside of Islam who live in Mesopotamia. But little is known of their inner life except to the initiated, for they resist all attempts to question them; and, when driven into a corner, will put off the inquirer with a fiction. The acceptation of these stories as true has been the origin of mistaken conceptions concerning them. Complete reservation of their religious precepts from strangers is one of their most binding obligations. To make secrecy more effective, the founder of the sect, Sheik Adi, decreed that only a single person at a time should be initiated into the mysteries, and designated as the person to whom the secret should be confided, the eldest heir of the tribe of Hassan el Bassri. Previous to his initiation this person is to be instructed in written Arabic, knowledge of which is forbidden to all others of the race, under penalty of death and loss of eternal salvation. The instruction takes place in a room from which all other persons are excluded. The text-book is the Koran, the only book obtainable in the country; but as this book contains many unflattering mentions of the devil, whose name no Yezidee must hear or pronounce or read, a friendly Christian is employed to procure the copy to be used and carefully cover all places where the devil is named with wax. If now by any accident the devil's name should be seen on the page during the studies, the book is shut at once, with an invocation, and thrown into the fire, and another one is procured. When the course of instruction is completed, the Koran is burned at once, because it is a wicked, blasphemous book, which should not be tolerated in the house of a Yezidee except under the sternest necessity. Instead of being devil-worshipers, as they are commonly called, the Yezidee religion is so fortunate as to have no devil.

By a most extraordinary accident the author obtained the sacred book of the Yezidees, whose place of concealment is known only to the single initiated, and was able to keep it long enough to copy it. Previous to entering upon the analysis of its contents, it will be proper to give a short account of the Yezidee people. They belong to the Kurdish race, and claim a population of three million souls. They are distributed in villages, residence in cities being forbidden, a few living in the provinces of Damascus, Aleppo, and Diarbekir, a greater number in the province of Mosul and the Russian district of Erivan. They are all subject, body and soul, to a chief who must be of the family of Sheik Adi,

and who resides at Baadri, in the district of Shechan. He receives a considerable tribute from his people, and has in turn to keep up the temple and grave of Sheik Adi. The present chief is Myrza Bey, a son of Hussein Bey, who a few years ago died of drunkenness. He was the third of eight brothers, and had no right to the succession, but he formed a party and advanced claims. In the contest which followed, his elder brothers fell by his hand, and he thus made himself master of the situation. He then managed to make his peace with the Turkish Government, and was recognized by it. The Myr, as the chief is called, has supreme control of all the possessions of the Yezidees. To deny a wish expressed by him is to incur very unpleasant results in this world, and also to bring upon one's self the consequences of having offended the bodily descendant and representative on the earth of the great prophet Sheik Adi. All contests are settled at his tribunal, not by any fixed law, but according to his will and passing mood. Bloodshedding is atoned for by pecuniary indemnity; adulterous women are executed by their husbands without further proceedings. The Turkish Government is satisfied to receive its tribute, and lets the internal affairs of the people alone. It deals with the Myr, to a certain extent, as a state within a state. The Yezidees will not serve in the Turkish army, because their religion forbids them to mingle with the hated Mussulmans, but escape by paying a good round commutation fee yearly. The people are at the lowest stage of civilization, with no hope of rising so long as Sheik Adi's rules are in force. Under the influence of these conditions and of the prejudices of their neighbors against them, they have become a sinister, malicious, treacherous people. The rite of hospitality, so sacred among the Bedouins, is unknown to them. No one can feel safe among them. They attach no value to human life. To these ordinary dangers are added those arising from the embarrassing etiquette of conversational intercourse with them; for if any one inadvertently lets escape the word devil, Satan, or anything sounding like it, he commits a mortal offense; and to cut off his head is a God-pleasing act, and a sacred duty of the Yezidee, the fulfillment of which will insure him a place in paradise. Several letters are in like manner wholly banished from the language, chiefly those which contain the sound of a "shun"; also the Arabic word *nallet*, "Thou art damned," which was spoken by God to the fallen angel when he pitched him into hell. Therefore all words containing similar sounds are set aside, and other combinations not belonging to any language are used in their stead.

The Yezidees in the level regions of Shechan are quiet farmers and stock-raisers, paying their tribute to the Turkish Government without remonstrance; but on the Jebel Sindiia they are

wild and indomitable, addicted to highway robbery, in constant antagonism with the Government, and often compelling the officers to use force in the collection of the taxes.

The great national sanctuary of the Yezidees is "Sheik Adi," the supposed burial-place of the founder and prophet of the religion. It was formerly a Chaldaic cloister, called Lalish, but was captured by the adherents of Sheik Adi, about the middle of the tenth century. It is in a beautiful valley, shaded with a rich vegetation, through which flows the sacred brook Semsen, coming down underground from Jerusalem, and here leaping from terrace to terrace. Every Yezidee is baptized and has his winding-sheet dipped into its holy waters, in order that he may be more sure of entering the paradise which Sheik Adi has promised him. Here resides the great sheik, who is next to the Myr, and whose blessing is good for the healing of diseases and for the assurance of a large posterity. The next place in the hierarchy is held by Mullah Haidar, a descendant of the learned Hassan el Bassri, and keeper of the book with the seven seals.

In one of the apartments of the temple are preserved the six sacred brazen images. They are roughly cast figures, in the shape of plumply developed cocks, one of which weighs more than seven hundred pounds, while the others are smaller. They are a gift from the dying prophet. There were originally seven of them, but one has been unaccountably lost. The holy book was also concealed for a time in Sheik Adi. This book was probably written in fairly good Arabic, at about the end of the tenth century, by Hassan el Bassri, Sheik Adi's disciple. It has existed since then in only a single copy, and is divided into two parts, of which the first contains the history of the creation, in occasional agreement with the Biblical narrative; and some account of the origin of the Yezidees and their subsequent fortunes, not always accurate, and containing many anachronisms. The second part —which is evidently to a considerable extent of later origin, for it shows various handwritings—explains the doctrines, precepts, and rites. The occurrence of Chaldaic words indicates that some Christian or ex-Christian priest or monk had something to do with its construction. According to this curious book, darkness prevailed before God created the heavens and the earth. He became tired of hovering over the water, and made a parrot, with which he amused himself for forty years. Then he became angry with the bird, and trampled it to death. The mountains and valleys arose out of its plumage, and the sky from its breath. God then went up, made the dry sky, and hung it to a hair of his head. In the same way hell was made. God then created six other gods out of his own essence, in the same way that a fire divides itself into several flames. These six gods are the sun, the moon, morn-

ing and evening twilight, the morning star, the other stars, and the seven planets. Each of them made himself a mare, with which to travel over the sky. The gods talk with one another in Kurdish, the speech of paradise, the language of languages. The seven gods together created the angels. It came to pass that the angel created by the first god rose against his lord, and was cast into hell for it. He at once set up a great lamentation, with confessions of his faults, and wept continually for seven thousand years, filling seven great earthen jars with his tears, till at last the all-good and merciful God had pity on him, and took him again into paradise. This angel afterward so excelled the others in doing good that God loved him more than all of them. The other angels once in a quarrel taunted him with his single sin and punishment. God overhearing this became very angry and said: "Whoever of you offends this little one with another word shall be accursed; whom God hath pardoned, the creature shall not make ashamed." He raised this angel to be first and master of all, called him Melek-Taus, and united him with his own person and existence, as two flames become one. The seven jars filled with the tears which he wept in hell are to be preserved till Sheik Adi shall return after having completed his mission on the earth, to be used in extinguishing the fires of hell.

The seventh god created the various species of animals, gradually, one out of the other, and finally Adam and Eve. But their posterity could not maintain themselves. After ten thousand years the earth destroyed them all, and then remained desolate for ten thousand years longer. Only the genii survived. The same thing happened five times again, each god creating a human pair in his turn. Finally the first god, with Melek-Taus, created the last first pair, Eve a considerable time after Adam, and not till after he had been expelled from paradise. Adam lived in paradise, and was allowed to eat of all the fruits growing there except of wheat.

In the course of time Melek-Taus said to God: "You have created Adam to people the earth; but he still lives in paradise, while the earth is uninhabited." God said: "You are right; take counsel about it." Melek-Taus went to Adam and moved him to eat of the forbidden fruit, upon which his expulsion from paradise followed as a punishment. God then determined to give Adam, who was still alone, a companion, and made Eve from his ribs, who bore him seventy-two pairs of twins. The Yezidees are not, however, descended from this race, but from a son miraculously given by God to Adam, named Shehid-ibn-Giarr, and a houri from paradise. Their posterity, the Yezidees, do not mingle with the children of Adam and Eve.

Shehid's eldest son was Yezdani, from whom, through his son

Noah, also called Melek Salim, the blessing passed to his grandson Marge Meran, the father of the Yezidee race. The Mussulmans are descended from Ham, who, having detected his mother in an intrigue, mocked her to his father. The children of Eve and of Ham hate the children of Yezdani, because they are the chosen people of Melek-Taus, who induced their father to eat the forbidden fruit, thereby forfeiting paradise.

The children of Eve laughed at Noah while he was building the ark in anticipation of the flood. When the ark struck on Mount Sindiar, it sprung a leak. The snake swelled itself up and stopped the hole with its tail; but after the flood, the snakes increased so fast as to do much harm to men. Noah was so vexed at this that he seized one of them and threw it into the fire. From its ashes arose fleas.

The history is continued, with a mixture of distorted incidents from the Old and New Testament accounts, the life and sufferings of Christ, stories of the Koran, and secular history. Christ, after suffering, but not actually dying, upon the cross, was taken by Melek-Taus into heaven, where, with him and God, he forms the Trinity.

Yezid, who made war upon his father, the Caliph Moanzeh, although he lived in reality a Mussulman, but unorthodox, is fabled in these books to have been a great champion of the religion of Sheik Adi, and to have possessed miraculous powers. He is said to have ordered all the books of Islam to be brought together and cast into the sea, and to have pronounced a curse of body and soul against every one, except those to whom special license might be given, who should thereafter read or write a letter of the Arabic language. Having overcome Hussim and Hassan, the sons of Ali, Yezid lived three hundred years at Damascus and then ascended to heaven. The Mohammedans obtaining possession of Damascus again, and beginning to oppress the faithful, Yezid was sent down to earth to protect them. This time he took the name of Sheik Adi. He again performed many wonderful works and effected some marvelous conversions, receiving the adhesion, among others, of the Caliph and of Hassan el Bassri, and drove the Christian monks from Lalish, where he established the seat of his religion. Jews, Christians, and Mohammedans, says the book of Sheik Adi, "curse and blaspheme in the way that they are led by their books. They are blind and hardened, and do not know that God comes down from heaven every thousand years and punishes blasphemers. They habitually speak of Satan, meaning thereby our holy Melek-Taus, who is one with God. This wicked name was invented by infamous and accursed people to shame our august protector. It is no less sinful to let words of similar meaning or like sound pass over the lips, such as *kaītan* (a sting),

shat (the Tigris), *shed* (to bind), *nál* (horseshoe), and *lál* (a ruby). Whoever speaks one of these words is guilty of the most heinous blasphemy and deserves to die, and his soul shall be embodied in a mangy dog or a beast of burden. Therefore God forbids the reading of books, because such words are contained in them. Neither the Bible nor the Koran originally had these blasphemous passages, but they were added by evil-doers. It is also a great sin to eat salad, because its name (in Arabic) sounds like one of the titles of our saints."

The priestly order is hereditary, in the lines ordained by God, and includes, after the Myr, or high-priest, the Apiars, who reside at Sheik Adi, and dispose of their blessings for good money; the Meshaich, who, without having any particular ecclesiastical functions, pray for the healing of diseases and break the bread at marriage ceremonies; the Kovechek, who dance at the festivals and on other occasions; the Kavalin, who constitute the guard of honor to the seven holy images, make music, and attend to the collections; and the Fakirs, who are organized as begging-monks, and live wholly on alms. All these priests wear their beard and hair uncut, and can marry only within their class.

The Sanjak, or Holy Standard of the Yezidees, is asserted to have come down from King Solomon, having passed from him to the kings of their nation, and having been committed by Yezid to the Kavalin to care for. As among them, it is consigned to the one who will bid highest for the privileges and blessings attendant upon having it in possession. On stated occasions the Sanjak is carried around and exhibited to the people. The priest dips the standard into the holy water, and, taking some of the consecrated earth of Sheik Adi, makes of it pills as large as a hazel-nut, which he keeps as blessed gifts for the faithful. Whoever swallows one of these pills will be kept by the grace of Melek-Taus sound in mind and body for a whole year. The standard, preceded by a herald to announce its coming, is taken to the villages as they are designated by the Myr. The privilege of entertaining it having been sold at auction, the successful bidder makes a feast in its honor, which is attended by the priests in their order, and by the people, and, finally, the women and children. Offerings are brought and laid down, and at sunset all the faithful march seven times around the standard in honor of the seven gods, beating their breasts and asking pardon for their sins. When all the villages in the circuit have been visited, the standard and the collected offerings are brought to the temple.

Sheik Adi is the true Jerusalem, or center of the faith. At the beginning of the autumn the Myr and the Meshaich meet there in a cave and inquire of Melek, who appears to them, whether a festival will be agreeable to him. If the answer is

favorable, the report is sent out, and in the course of twenty-three days thousands of Yezidees, with their wives and children, will have collected at Sheik Adi, bringing with them provision of a peculiar cake, for no kind of food must be prepared there during the pilgrimage. On the twenty-third day, the great Sheik comes out from the cave, takes his seat upon a stone, and salutes the people. Every person, thirty years of age and over, must bring an offering from his live-stock, according to his means. The Meshaich now come out of the cave and join the Emir on a high tribune, where, with the priests of the other orders, they form the Council of the Forty. An ox is stewed in a big kettle from morning till sundown, when at the call of the Emir a number of young men come up, and, plunging their bared arms into the hot mess, accompanied by ceremonial music, pull out the pieces of meat and distribute them among the Emir and the Council. The skin and flesh of the young men's arms may peel off to the bone, but those of them who die are at once enrolled among the saints; and in their honor the hunters of Sindiar and Chartie climb to the top of the mountain and loudly clash their shields together, or, more recently, fire volleys of musketry. This ceremony is called *kabaah*. Every one of the attendant faithful receives a share of the broth, making an offering equivalent to about a sixpence in return. After three days of the festival, the faithful are all baptized in the waters of the holy Semsen—a stream which issues from a cave into a broad, stone-lined basin—and after them the women and girls receive a dip. The water for drinking is taken from a pond into which the water flows from out of this basin. None can be drawn from the upper part of the source. Three of the holy images are ceremonially dipped in the brook, carefully dressed, and arranged around the Sanjak; each of the faithful takes a little of the sacred earth and presents his offering, and the festival is ended.

The religious ceremony of marriage consists in the couple going before the Sheik and eating a piece of bread which he has broken in two. A feast is given afterward, at which the attendants contribute toward a gift to the Myr, in commutation of his sovereign rights. Weddings are not celebrated in April, or on Wednesdays and Fridays. The relatives of a widow have a right to give her in marriage, whether she be willing or not, to the sixth time, after which she is at liberty; but, if she will pay the relatives as much as the new suitor offers, she discharges the account, and they have no further control over her. The marriage bond is dissoluble by death, by removal, by putting the wife away on account of transgression, and, without cause, after eighty years of it.

The priests claim the power to heal diseases through the inter-

position of the saints, and by the water of the brook Semsen and the earth of Sheik Adi. They say that Rejel-el-Senne occasionally sends his plague-soldiers to vex men; when they repent of their sins and confess them, the saints intervene to vanquish the pest-soldiers and drive them away.

The souls of deceased believers are supposed to go into paradise to dwell with the seven gods, Melek-Taus, and the saints. Sheik Adi is the door-keeper there. The souls of unbelievers and of sinful Yezidees go into the bodies of asses, mules, and dogs. Upon the death of a Yezidee, his mouth is at once filled with the holy earth of Sheik Adi. The body is buried under the direction of a sheik and the kavalin. The body having been laid in the grave, facing the east, some sheep's dung is scattered over it, and the grave is filled up with earth. The women mourn, sing dirges, beat their breasts, and tear their hair for three days; and, if a traveler comes along, he is entertained for the salvation of the soul of the deceased. The mourners and their friends afterward meet in the house of the deceased, where the Kovechek dance and sing to Melek-Taus till they look him in the face, when they are seized with convulsions, and fall senseless to the ground. This is a sign that the soul of the deceased has entered paradise. The whole winds up with a funeral feast.

If a man has an evil-disposed son, he secretly buries his wealth, so that it shall not be wasted after his death, and marks the spot with some sign. When he is born again, to lead a new life, as his religion teaches him is to be the case, he will go and recover his treasure.

New-year's-day is a great festival, and is always observed on the first Wednesday after the vernal equinox. On this day, God collects in paradise all the saints and their relatives, and sells the world's coming year at auction. The highest bidder is made Rejel-el-Senne, the ruler of the year, and has the direction of men's fates according to his will, and the distribution of plenty and happiness, want and disease. On the morning of the previous day the Kochek calls from his house, imploring from Melek-Taus blessing upon all who are within hearing of his voice. The young people then go to the mountains and woods to gather red shkek flowers with which to adorn the doors of their houses; for no house not thus ornamented can be secure from the afflictions of the year.

The legend of Sheik Adi's call to be a prophet relates that, as the holy man was riding over the fields one moonlight night, in his twentieth year, there suddenly appeared rising from the ground, in front of the tomb of Abu Rish, a vision of two camels having legs four cubits in length, with heads like those of buffaloes, hair long and bristly like a thorn-bush, large round eyes

glistening with a greenish luster, jet-black skins, and other features like those of men. The tomb had become immensely large, and had taken the shape of a minaret towering into the clouds. It then began to shake, and Sheik Adi in his fright overturned a water-jar that was standing by his side; and the apparition, which had turned into the shape of a handsome boy with a peacock's tail, exhorted him: "Do not be afraid; the minaret, indeed, will fall and destroy the earth, but you and those who hear your word shall not be harmed, and shall rule over the ruins. I am Melek-Taus, and have chosen you to publish the religion of the truth over the earth." This said, he took Sheik Adi's spirit with him into heaven, where it stayed for seven years, receiving instruction in all truths, while the body of the saint remained asleep by the tomb of Abu Rish. When his soul returned to it from the sky, the water had not yet run out of the overturned jar. — *Translated for the Popular Science Monthly from Das Ausland.*

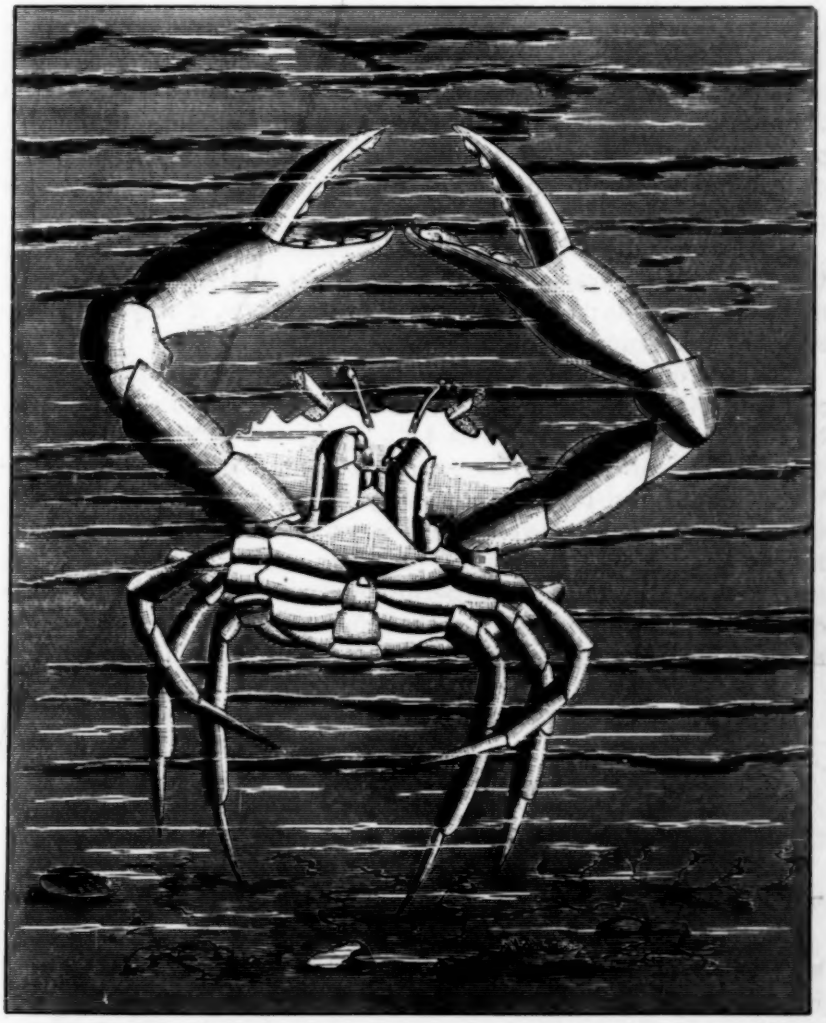
THE DANCE OF THE LADY CRAB.

By T. H. MORGAN.

ABOUT the 12th of September, 1888, there was brought into the laboratory of the United States Fish Commission a male specimen of the lady crab (*Platyonychus ocellatus*), which was placed in an aquarium with a female crab of the same species. During the evening of the 13th, while sketching some hermit-crabs which had previously been placed in the same tank, I was attracted by the movements of the male Platyonychus. Without apparent cause he was seen to rise upon the third and fourth pairs of legs; his large chelæ were thrown above his head with the claws open and their points touching in the middle line; his fifth pair of feet were held horizontally behind, and his body perpendicular to the floor of the aquarium, or at right angles to the normal position, as shown in the accompanying figure. The posture was ludicrous, and, when in this position he began slowly to gyrate, his movements and attitude were the cause of much merriment upon the part of the spectators. At times he balanced on two legs of one side, again on two legs of opposite sides. Now he advances slowly and majestically, and now he wheels in circles in the sand on the floor of the aquarium, and now for a few moments he stands as if transfixed in this unnatural position. An electric light hung above and to one side of the water, which suggested the possibility that it might be the exciting cause. It was turned out, and still the dance went on, and the joy was unconfined. At

last, from sheer exhaustion, he sinks down to the sand in his usual attitude.

But now the female, who has all this time remained tucked away in the sand, comes forth and begins to move about the aquarium; soon she comes near to the male crab, when instantly he rises to his feet and begins to dance. Again and again the per-



DANCE OF THE LADY CRAB (drawn from life by T. H. M.).

formance is repeated, and each time the approach of the female is the signal for the male to rear high upon his hind-feet, and to reel about the aquarium as if intoxicated.

At times, when the female approached as he danced, he was seen to make attempts to inclose her in his great chelate arms, not

with any violence, for the claws never snapped nor closed violently; but she was coy, however, and refused to be won by his advances, for the dance may have been nothing new to the lady crab, nor half as interesting as it was to the two spectators outside the water. Later, he too buried himself in the sand, and the performance came to an end.

The next day, and the day following it, the two crabs were watched, but without anything unusual taking place. The colors and markings of the male and female were much the same, though it seemed that the male had slightly more brilliant tints. To determine whether or not there is any marked sexual difference, a greater number of both sexes will have to be examined, and this at the time when the males woo the females under perfectly normal conditions.

Performances such as these are by no means uncommon among the vertebrates, especially with male birds in their endeavors to attract the female; but I believe there are few, if any, performances of this kind on record below the vertebrates.

To any one who has watched the crabs in their natural environments, the complex psychological development which may here be brought into play will not be surprising; yet, if the instinct which leads the male to dance is the same that we see in male birds, and if the female shows any discrimination between the dancers, the mental development must be considerable. Darwin has, in his "Sexual Selection," recorded among Crustacea many instances of difference in structure, and a few cases in which the color* of the two sexes is slightly different, but does not mention any performance comparable to the dance of the Platyonychus.

ON THE CAUSES OF VARIATION.†

By C. V. RILEY, Ph. D., United States Entomologist.

I.

WHATEVER influence we may attach to environment and external conditions, it is self-evident that they alone have not been sufficient to induce the wonderful variety of life existing upon the globe to-day. Indeed, so far as natural selection implies necessary utility, necessary adaptation to surroundings, it is, as I have said, defective. We know very well that introduced species from one continent to another, or from one country to another, have proved better adapted to the changed conditions

* Prof. Coun has reported a sexual difference in color in Callinectes.

† From the address of the Vice-President of Section F of the American Association for the Advancement of Science, delivered at the Cleveland meeting, August, 1888.

than the indigenes or endemic forms. This is readily comprehended on two grounds: First, that species which have, in the course of time, experienced a greater struggle among themselves in large areas, have an advantage over those in more limited areas in which the struggle has been less intense; secondly, that species which have accommodated themselves to the changes in life conditions which civilized man induces, have a great advantage when, following man's migrations, they are brought into competition with species which have not yet been subjected to such conditions. Again, no valid reason can be urged why, within a given area, one species predominates over another in so far as mere adaptation is concerned. The influences of environment alone would tend to unify the fauna and flora of a given region. Theoretically, so far as climate and physical conditions are concerned, there is no reason, through regions where these are uniform, why a single animal should not prevail to the exclusion of all others, providing it was vegetarian, or that the particular plant which furnished food to such an animal should not prevail to the exclusion of all others. The hickory and the blade of grass must be considered equally adapted to the environment with the oak, and so on all through the multifarious forms of both vegetal and animal life: so that this diversity of form can best be explained by some principle like natural selection, and by the interrelation and interaction of organisms and the struggle between them for existence. This is illustrated in many directions. To take a striking example: no one doubts that if the larger carnivora of Europe and Asia were introduced into Australia, the marsupials would soon have to give way, and could survive only by the acquisition of special functional modifications and larger intelligence such as we find in our opossum. Yet it would be folly to conclude that the marsupials are less well fitted to the physical conditions which obtain in Australia than their introduced exterminators.

From what has preceded, we are, I think, justified in rejecting the interpretations of both extremists as to the scope and meaning of natural selection. It can not be debased to the mere expression of the universally observed fact of variability; yet it must be restricted, because it not only implies something to be selected, but its promulgator limits its scope to the selection of something that is useful. As a philosophy it considers only processes, and leaves remote origin and cause untouched. The following limitations are probably justified to-day, and will help to more exact use of the term:

1. It deals only with individual variation from whatever cause, and should not be applied to simultaneous variation in masses.

2. It deals only with variations useful to the organism in its struggle for existence, and can exert no power in fixing the endless number of what, from present knowledge, we are obliged to consider fortuitous characters. It can not perpetuate useless organs; nor those of a vestigiary or obsolescent character.*

Even with these restrictions, the principle is far-reaching and profoundly important; but it quite fails to account for many of the most interesting manifestations of life that are obviously not necessary or life-preserving, of which many will occur to every one, such as, among lower organisms, many superficial details of structure; or, as among higher organisms, odd habits and customs, playful instincts, ethical traits, etc. Its limitations must be narrowed in proportion as we come to understand the other laws of modification and the causes of variation in masses. Let us briefly consider some of these causes.

We soon find that they admit of a certain amount of classification, the minor divisions of which, as in all systems of classification, more or less fully interlock or blend. They fall, however, into two chief categories, viz., (1) external conditions or environment, which are, at bottom, physical, and (2) internal tendencies or promptings, which are, at bottom, psychical. We shall also realize more fully that there is good reason for the varying importance which has been placed on natural selection because it represents a broad principle, based on the outcome of both these categories, but particularly of the latter. Its value is not a fixed one, and must needs change with the increase of exact knowledge of the other factors, and did in fact change in the mind of its originator. We shall further find that there are laws of evolution which permit of formulation and expression, and which have influenced or controlled the mode of variation, but which must not be confounded with or included among the causes of the variation proper, though here, again, the line between the two kinds of factors is not always easily defined.

The conditions of organic modification may, therefore, roughly be classed as (A) external and (B) internal, and these may be almost indefinitely subdivided. The former class includes (1) *physical* and (2) *chemical* forces, and in a broad way may be said to induce modification independently of natural selection, however much this may act with them as a secondary cause. Certain prominent features of the physical forces are worthy of mention: as light, temperature, water (stagnant, or in motion), climate (under which term may be included meteorologic phenomena, as electricity, atmospheric pressure, etc.), mechanics (gravitation, wind, stress, friction, etc.) and geographics (migration, isolation, etc.).

* In the literature of evolution, these are usually termed rudimentary, but, strictly speaking, this term should be applied only to nascent or incipient structures.

The chemical forces may be considered under the subdivisions aquatic, atmospheric, food, and soil. In class A may also be included (3) *vital** or organic force in so far as this is concerned with the interaction of organisms, and it is seen thus to link the two great classes. The second class (B) includes (1) *physiological* and (2) *psychical* forces. Prominent among the former, as causes of modification, are worthy of mention those connected with genesis itself: as heredity, physiological selection, sexual selection, hybridity, primogenital selection, and what I would call sexual differentiation, and philoprogeneity. Among the latter may be included use and disuse, individual effort, etc.; and last, but not least, the emotions.

Now, with the limited definition given to natural selection, all the forces in class A act independently of it, while the rest are more or less fully aids to its action. Time will not permit of much detailed consideration of the physical and chemical forces. Nor is such consideration necessary; for their influence, as Darwin well remarked, is obvious. Fundamentally, they must needs limit and control all manifestations of life, of which indeed, on evolutional grounds, they are the material basis. Change of physical environment may affect function first and chiefly, but this involves change of form and structure which are integrated by heredity. The surface of the earth and the waters upon it and the atmosphere above it have necessarily conditioned the chief modes of animal locomotion, as swimming, flying, crawling, and walking, while the five great classes of vertebrates find the explanation of their structure, as J. B. Steere pointed out at the Ann Arbor meeting, in the conditions of life in water, in shallows, in the air, on land, and on trees and rocks.

External Conditions.—By external conditions, or environment, we include all influences on organisms which act from without, and in carefully considering them we shall find it difficult to draw the line between those which are really external and independent of any motive or inherent tendency in the organism, and those which are not. Hence, the general term "external conditions" is resolvable into various minor factors. Considering the influences as a whole, we find that in the 1844 essay, or sketch, Darwin gave more weight to them as producing variations, and as modifying habit, than he did in the "Origin"; yet we all know that he felt convinced, when this work was first issued, that natural selection was the main, though not the exclusive, means of modification. Before his death, he was again led to attach greater

* I am well aware that this term is much tabooed among a certain class of the more materialistic evolutionists, but I use it here for want of a better, and because, as an expression of one form of manifestation of force, it has as much a classificatory value as physical or psychical.

importance to them. As late as March, 1877, he wrote to Neumayr, of Vienna, that "there can not be any doubt that species can be modified through the direct action of the environment. I have some cause for not having more strongly insisted on this head in my 'Origin of Species,' as most of the best facts have been observed since its publication." He was led to this modification of his views by Neumayr's essay on "Die Congerien," and by Hyatt's work in showing that similar forms may be derived from distinct lines of descent. In his correspondence with Huxley, Darwin remarks that one point has greatly troubled him. If, as he believed, accidental conditions produced little direct effect, "What the devil determined each particular variation? What makes the tuft of feathers come on the cock's head, or moss on the moss-rose?"

It is quite plain, indeed, that subsequent to the publication of the "Origin," and especially in 1862, in his correspondence with Lyell, Darwin was inclined to give more power to physical conditions, and, in fact, was wavering in his mind as to the force of the different influences at work. In his letters to Hooker, in 1862, the same tendency may be noted, and the preparation of the "Variation of Animals and Plants under Domestication" led him to believe rather more in the direct action of physical conditions, though he seemed to regret it because it lessened the glory of natural selection, and, to use his own language, "is so confoundedly doubtful." One can plainly trace from the correspondence how, prior to the publication of the "Origin," he more and more, as his facts accumulated, and as the theory of natural selection grew upon him, relegated to an inferior place the influence of environment; while, subsequent to the publication of that work, and up to the time of his death, the tendency seemed to be in the opposite direction.

Many eminent workers have differed greatly from Darwin in the influence allowed to these external conditions, and this is particularly the case with our American writers. Indeed, no one can well study organic life, especially in its lower manifestations, without being impressed with the great power of the environment. Joseph Le Conte speaks of the organic kingdom lying, as it were, "passive and plastic in the molding hands of the environment." Leidy, Wyman, Clark, Packard, etc., have insisted on the influence of physical conditions. Baird and Ridgway on geographical distribution, Whitman on concrescence, Hyatt on gravitation, Cope and Ryder on mechanical stress, have all published valuable corroborative evidence; while many other writers have added their views and testimony, which have been admirably condensed by Prof. Morse in two addresses before this association. Allen demonstrates plainly the influence of climate and temper-

ature in directly inducing specific changes. Weismann, in his remarkable "Studien der Descendenz-Theorie," concludes that differences of specific value can originate only through the direct action of external conditions, and that allied species and genera, and even entire families, are modified in the same direction by similar external inducing causes. In Semper's "Animal Life" (1877) we have the best systematized effort to bring together the direct causes of variation, and no one who has read through its pages can doubt the direct modifying influences of nutrition, light, temperature, water at rest and in motion, atmosphere still or in motion, etc., or question his conclusion that no power which is able to act only as a selective and not as a transforming influence can ever be exclusively put forth as a *causa efficiens* of the phenomena. Kölliker, in 1872, wrote: "Manifold external conditions, when they operate on eggs undergoing their normal development, on larvæ or other early stages of animals, and on the adult forms, have produced in them partly progressive and partly regressive transformations"; and recognized as most important forces, nutrition, light, and heat. Indeed, the direct action of environment must have been, as Spencer puts it, "the primordial factor of organic evolution."

In so far as it offers evidence, entomology confirms the conclusions of the writers in other departments of natural history, above referred to, and offers a host of most conclusive proofs of the direct action of the physical and chemical factors which I have enumerated. Justice, however, could not be done to the facts within the limits of an address of this kind, and I pass on to some of the other factors.

It is among what I have called the vital or organic conditions of variation that natural selection has fullest sway, and, as they have been so ably expounded by Darwin and others, they may be dealt with in few words.

Interaction of Organisms. — The productions, as a whole, of greater areas will, whenever they get an opportunity, conquer those of lesser areas, and in this broad sense the interaction of organisms may be said to have had no special modifying power, however great its influence may have been, and is yet, in inducing the survival of the fittest, or in bringing about the present geographical distribution of species. The consequences of enforced migration and of isolation are best considered when dealing with the physical conditions, because they must influence modification of masses rather than of individuals, and either substitute one type for another or remove competing or differentiating influences. But, in the more restricted sense, i. e., the interaction of organisms occupying the same ground—the struggle for existence, in other words, between direct competing organisms—is a prime

Darwinian factor of modification, and a whole volume of illustrations may be drawn from entomology; for in no class is the contest more severe, whether with plants, or with other animals, or with one another, than in insects. In no other field of biology, for instance, have the physical conditions resulted in such infinite diversity of form and habit fitted, whether for earth, air, or water, and often for all in the same individual; so, also, in no other field is parasitism carried to such a degree, or are the purely adaptive structures due to this interaction so varied or so remarkable. The entomologist who goes beyond the "dry bones" of his science is inevitably a Darwinian.

In this category must also be included that interrelation between insects and plants which has eventuated in the so-called carnivorous plants, and that still more wonderful interaction between flowers and insects by which each has modified the other, and the facts of which have been so untiringly observed and so well set forth by a number of writers from Sprengel's day to this, and by none more successfully than by Darwin himself. These are plainly inexplicable on external conditions acting on masses alike, and are meaningless enigmas except on the theory of natural selection, or some supra-natural and dogmatic gospel.

We are thus led, through this last, from the external to the internal factors in evolution, or those of a physiological and psychical nature. In these, natural selection is the key which, so far, best unlocks their meaning, and shows how they have acted in the formation of species and the less fundamental of the great groups. In considering them it is hardly necessary to discuss their relative importance as compared with the external conditions, though it may be remarked that they are the factors which have induced the great variety of adaptive forms and minor differentiations, while the external conditions have governed the formation of the great and more comprehensive types of structure.

Darwin was led to give more importance toward the end than he had originally done to some of these internal factors, and especially to functionally produced modifications. In the "Descent of Man" he says that he did not sufficiently consider variations "which so far as we can at present judge are neither of benefit nor injurious; and this I believe to be one of the greatest oversights I have yet detected in my work." And in the sixth edition of the "Origin" he frankly admits that he had omitted in other editions to consider properly the frequency and importance of modifications due to spontaneous variability. He further refers to morphologic differences, which may have become constant through the nature of the organism and the surrounding conditions rather than through natural selection, since they do not affect the wel-

fare of the species. In short, Darwin's views kept pace with the investigations of his day, and tended in the direction of restricting rather than widening the influence of natural selection. But, as Romanes, and especially Spencer, in his "Factors of Organic Evolution," have fully shown Darwin's position on this subject, I may pass over the detail.

INTERNAL CONDITIONS.—*Physiological.*—*Genesis* itself is the first and most fundamental of all causes of variation. The philosophy of sex may, indeed, be sought in this differentiation, as the accumulated qualities in separate entities when suddenly conjoined or commingled inevitably lead to aggregation and heterogeneity—in other words, to plasticity or capacity to vary. Genesis, as a fundamental factor in evolution, may be more intelligently considered under some of its subordinate phases, as heredity, physiological selection, sexual selection, primogenital selection, sexual differentiation, including philoprogeneity, hybridity, etc.

Heredity, as expounded by the ablest biologists, and as exemplified in life, is a puissant factor in evolution, and, though essentially conservative, must, through the marvelous power of atavism, tend to increase individual variability. The subject has been too well considered by Darwin and his followers to justify further discussion of it here. As a cause of variation, heredity must, however, have less and less influence as we go back in the scale of organized beings; for it can not well come into play in agamic or fissiparous reproduction, a fact which has given the abiogenisists one of their strongest arguments, since it is difficult to understand how, for instance, the monera of to-day could have descended without change from the primordial form.

Physiological Selection.—Physiological selection, as suggested by Mr. Catchpool and as expounded by Romanes, is undoubtedly a veritable factor in evolution, and, while giving us another link in the chain of evidence as to the causes of differentiation, lessens in but very slight degree the overwhelming force of the argument for natural selection. It adds, rather, an important element in the evidence therefor, and may be classed as a subordinate cause of differentiation. Romanes's theory is based upon the argument that differences, such as constitute varieties and species in their commencement, would not be preserved by natural selection unless useful, but would be lost again by cross-breeding with forms like the parent, and which had not varied, except upon some hypothesis like that of physiological selection. This could not be prevented except by migration. This difficulty is a general one, was argued by Darwin himself, and has been felt by all Darwinians. The reproductive organs are extremely variable, and sterility may occur not only between species, but between races and varieties, and often between individuals. Physiological selec-

tion tends to form varieties by peculiarities in the reproductive system of individuals, which render them unfit for perfect union, or cause them to remain more or less sterile, with other individuals which have not the same peculiarities.

The exact reasons are recondite, and the whole subject difficult of demonstration except from the results, since changes in the reproductive organs are not easily observable. Romanes believes this sterility to be incidental to variation, and hence one of the chief causes of the accumulation of such variation. Wherever there has been modification of the reproductive organs introducing incompatibility between two individuals, even where there has been no other change or variation, we have a valid cause of differentiation which in its consequences must be important. Compatibility or fertility between individuals is of the very essence of selection. Natural selection implies that this sexual divergence is subsequent to or coincident with divergences in other directions; physiological selection, that it antecedes them. To put the case of Romanes more fully, we will suppose that among the natural variations there occasionally occurs something to affect the reproductive organs in such wise as to produce incompatibility—i. e., incapacity of one individual with another of the parent type to unite, or sterility of such union, while it remains fertile with the variation of its own kind. This theory, of course, implies variation in the reproductive organs, or departure from the parental type, in at least two individuals of opposite sex simultaneously, and with this admission, for which we are justified in facts, physiological selection will preserve many peculiarities which need have no necessary connection with the exigencies of life.

The change may be in the organs of reproduction, introducing sexual incompatibility, or it may be due to other causes, as, for instance, the time of flowering in plants, or the season of heat in animals. Even the element of scent becomes important here, as my friend J. Jenner Weir has suggested, since it may influence sexual relationship, so that the very excretions of the body, which vary with individuals, must be allowed their part. Francis Galton has indicated a modification of Romanes's views, viz., that the primary characteristic of a variety resides in the fact that the individuals who compose it do not care to mate with those outside their pale. Incipient varieties are thus thrown off from the parent stock by means of peculiarities of sexual instinct which prompt what anthropologists call endogamy, and check exogamy or marriage without the tribe or caste. This is a very good anthropological illustration of how physiological selection may begin.

Natural selection preserves the individuals best adapted to life-conditions by destroying the less fit. Physiological selection may be said to preserve differences which have no necessary con-

nection with the necessities of life. Neither touches the origin of the variation, but both express laws thereof or methods by which it is accumulated. The inherent tendency to vary, whether in external or adaptive structure, or internal or reproductive character, is simply an observed fact, the causes of which we are endeavoring to analyze.

Physiological selection is remarkably exemplified in insects, and probably in no other class are the modifications which may be attributed to it more easily studied; for in no other class are the genitalia of the male so variable or so complex. There has so far been no attempt to homologize the different parts in the different orders of insects, so that they have received different names according to individual authors. Ordinarily there are two pairs of claspers, themselves very variable, associated with sundry hooks and tufts of hair. There are families, as in the *Cecidomyidæ*, among the *Diptera*, in which many species are almost, and others absolutely, indistinguishable except by the differences in the male genitalia. In all other orders there are an immense number of forms which can only be distinguished by a careful study of those organs. Descriptive entomology to-day, which does not take account of these organs, is in fact almost valueless, and we must necessarily assume that, where there is differentiation of structure in these important parts, it implies a corresponding modification on the part of some associated female, even where no other differentiated characters are to be detected, and upon Romanes's law such must be looked upon as physiological varieties, and will be counted good species in proportion as the differentiation involves other observable characters or as their life-habits determine.

Sexual Selection.—The part of sexual selection in inducing variation may next be considered. While it is evidently at the bottom of the diversity in sex so common among many animals, it is difficult to see how it can play any very important part in the differentiation of species, except on the hypothesis that the greater the differentiation between the sexes the greater the tendency to vary in the offspring. In no class of organism is this factor more notable than in insects, and volumes might be written to record the interesting and curious facts in this class alone. As a general rule it may be said that with insects, as with other animals, it acts chiefly in inducing secondary sexual characteristics in the male, and in simplifying the characteristics of the female. Nowhere do we find greater contrasts between the sexes, involving almost every organ, both colorationally and structurally. Where color is affected, the greater brilliancy almost always belongs to the male sex, as in birds. So, where song or sound is employed to attract, the sound-organs are either peculiar to, or most highly developed in, the males. As in higher animals,

also, so in insects, we find offensive organs highly developed in the male, and either lacking or but partially developed in the female, wherever the struggle for the possession of the female is by force or strength. It has evolved scent-organs in the various parts of the body, causing modification, especially in the *Lepidoptera*, of either the membrane of the wing or the scaly covering; it has induced profound modification in the structure of the legs, whether the anterior, middle, or posterior pair, and whether in the whole number or some part of it, or in its covering. The subject has been so fully treated by Darwin, however, that it is not necessary to elaborate it further in this connection. Strictly speaking, it may be said to act in two ways, viz., by conflict of the males for possession of the female, or by attractiveness, the former being most conspicuous among mammals, the latter among birds, and both coming conspicuously into play among insects. It is rather difficult to define the limit of sexual selection as a factor in evolution, but I would not confound it with another factor, not hitherto generally recognized, but which I think must be all-powerful, namely, sexual differentiation.

Sexual Differentiation.—It seems evident that the mere differentiation of sex in itself has been an important element in variation. The principle elaborated by Brooks as a modification of the theory of pangenesis is a good one, and in the main the male may be said to be the more complex and to represent the progressive, and the female the more simple and to represent the conservative element in nature. When the conditions of life are favorable, the female preponderates, and exercises a conservative influence. When the conditions are unfavorable, the males preponderate, and with their greater tendency to vary induce greater plasticity in the species, and hence greater power of adaptation. Sexual differentiation may, I think, be used to include many other variations and differentiations not otherwise satisfactorily accounted for, and to express the law of the interaction of the sexes upon one another, inducing great differentiation entirely apart from the struggle of the males for the possession of the females, or the struggle for existence. Among insects, particularly, though the same is true among other classes, we find many illustrations of this that can hardly be explained by the other forms of selection.

A few of the more notable in Hexapods may be instanced, as the degraded form of the female in *Stylopidæ;* in very many *Lepidoptera* and *Coleoptera;* in the females of the *Coccidæ*, in *Homoptera*, etc. In most of these cases it is the female which has been modified, without any very special modification in the male, though it is a general rule that, in proportion as the female is degradational and stationary, the organs which permit him to

find her, or to mate with her, and particularly the antennæ, eyes, and genitalia, are profoundly modified and complex. This is especially noticeable in the *Psychidæ*, where the female remains in her case, a mere mouthless, eyeless, legless, and wingless grub, and the male has most complex and ramose antennæ and complex genitalia. Another remarkable instance may be cited in the *Lampyridæ*, where we find every degree of degradation in the female, from partial wings to no wings at all, accompanied with increasing complexity of eyes and antennæ in the male, until at last, in the *Phengodini*, the female is so larviform that she can hardly be distinguished from the true larva. In all these cases the female has been as profoundly modified as, and often more so than, the male, and in the latter case a phosphorescent power has been evolved so that the attractiveness, as in the human species, is rather on the female side. Again, in the case of *Corydalus*, in *Neuroptera*, the profound modification of the jaws in the male into prehensile, sickle-shaped organs is to be explained rather on the interaction, between the sexes, and the facility the modification offers for union, than upon sexual selection in its proper and restricted sense.

In this category must also be included the influence of *philoprogeneity*, which has modified the female rather than the male either in the primary sexual organs for offense or defense, as in the sting of the aculeate *Hymenoptera;* or in the secondary sexual characters, as in the anal tufts of hair, secretory glands, etc., of many *Lepidoptera;* or in modification of various other parts of the body exhibited in various orders of insects to facilitate provision for their young, whether in the preservation of the eggs or the accumulation of food for the future progeny. A notable instance of how far this may be carried is furnished by the female *Pronuba*, where the ovipositor and the maxillæ are so profoundly modified as to make her unique in her order. Sexual selection can have little to do with these modifications, cases of which might be multiplied indefinitely; nor can they be fully explained by natural selection, in the restricted sense in which we have proposed to use it; nor by physiological selection.

In this category might also be included modification which has resulted in the various forms of females which obtain in the same species, fitted whether for agamic or sexual reproduction, and which are far more readily explained on the theory of sexual differentiation aided by environmental influence, especially food and temperature, than upon any other.

Hybridity.—The subject of hybridity has been fully discussed by many, and by no one more ably than by Darwin himself. It has generally been assumed that the hybrid of any two species is sterile, and, in fact, hybridity has been looked upon as one of

the best tests of specific value next to genetic incapacity. The assumption finds its greatest support in genesis among the higher animals, and the most thoroughly differentiated species; but the whole subject becomes complicated as we descend in the organic scale, and hybrids between what naturalists generally separate as good species are far more frequently fertile among plants and lower animals than was formerly supposed; while physiological selection, as we have just seen, may render genesis impossible, or at least prevent it, between varieties and incipient species. In this light, hybridity becomes an important factor in the modification of species. Unnecessary importance has been given, in my judgment, to the fact that domestic and wild species differ in the fertility of their crosses. It is assumed, for instance, that all the known breeds of domestic dogs would be fertile *inter se* and produce fertile crosses. It seems to me, on the very face, a preposterous proposition, and that many of the breeds of domestic dogs are as distinct specifically, and even generically, so far as this test is concerned, as they are in structure and other characteristics. Who, for instance, has ever known or heard of a cross between a bull-dog and a lap-dog, or between a Newfoundland and a black-and-tan? The difference in size alone would seem to render such a cross, if not a physiological or a physical, at least a practical, impossibility; so that hybridity among domestic animals tends to essentially the same result as among wild animals, and confirms its importance as a differentiating factor.

[*To be concluded.*]

THE STORY OF A SCHOOL.

By JAMES JOHONNOT.

IN this age of wholesale educational machinery the faithful record of any school, individual in its character, ought to be of interest to all who seek better results in practical ability than our present systems of instruction succeed in giving. But, when the school departs widely from recognized standards, its record is of double value, as calling in question prevalent customs, and affording a new criterion for the judgment of current methods. The tendency of instruction is to become set in its ways. Teachers follow precedent and reach formalism.

But from time to time particular individuals are found who ask the reason of this or that practice, and call in question its value as a means of culture. Hence arose the "teachers' institutes" in this country. They were first organized in the State of New York, in 1846. They grew naturally out of the progress in

liberty of thought. Time-worn methods of teaching were brought up for discussion and judged by their results, and in the light of reason.

Credit is surely due the founders and conductors of institutes, in that they brought about and persisted in this habit of questioning and discussing educational practices and principles. This was their special field of work. Their method was the true one, but the laws of life and of mental development were not then well enough understood, even by the best thinkers, to furnish safe guidance in this difficult work.

"The new education" means a revolt against all precise, ready-made forms, and an adoption of such methods as science may from time to time discover and point out. The "Story of a School" tells of the trials and triumphs of an experiment designed to test educational principles at which I had arrived through many years of "institute" instruction. In this constant comparing, discriminating, and sifting of methods I had obtained a special preparation for normal-school work. Herbert Spencer, in his treatise on education, had laid a solid foundation for scientific education, and Prof. E. L. Youmans had with voice and pen succeeded in arousing among thinking people a lively interest in the subject.

In the year 1872, through the agency of the Hon. John Monteith, Superintendent of the Schools of Missouri, I received a call to take charge of the newly established normal school at Warrensburg in that State. In the interview with Mr. Monteith I said suggestively to him, "You do not want me, and your board of regents will not want my services when they learn the conditions I shall exact."—"What may these be?" said he, with some curiosity in his tone. "Entire control of the school, without interference from the superintendent or from the regents," was my reply. Laughing, said he, "You are the very man we want," and added, by way of caution: "You understand that liberty implies responsibility. Give us right results, and we will trust to you for methods." I accepted the situation, and took up my work under circumstances singularly propitious to the experiment I was about to make.

The first thing that engaged my attention was the preparation of a course of study. It was an easy matter to select the required document from the catalogue of some noted institution, or I might have made a mosaic, adopting parts from several. A brief inspection of various catalogues showed that little thought had been bestowed upon the order of subjects in the course. One study might be made to take the place of any other, without the slightest disturbance in their relations. Of the natural order of growth in mind, and of the corresponding sequences in the sciences, they

had taken no account. To these laws I now turned for guidance, and tried to forget that a school curriculum had ever been constructed, so that custom should in no wise interfere with the free play of philosophic principles.

The subjects were arranged in their order of dependence as determined by comparative science. The course of study thus worked out differed quite materially from the ordinary, in spirit and in principles. It emerged as an organic whole, rather than as a loose array of disconnected subjects.

The physical sciences had first place, their treatment beginning with an observation of material objects and passing to a consideration of forces and of the laws of physical relations.

Another line of study treated of man and his environment. It began with a consideration of man as an inhabitant of the globe, dealing with geography, and it led up through history, literature, civil government, to mental and moral philosophy, and later on to rhetoric, logic, and political economy.

Besides these two main lines of thought, there were two subordinate ones, dealing respectively with language as a science and with mathematics. In our treatment of language the widest departure from the customary was made. Latin and Greek were excluded, as the State University already offered a much more complete course in the classics than our school could hope to give. But a still weightier reason constrained me in this decision. The time at our disposal for linguistic study was needed chiefly for constructive work in the vernacular. I determined to make the study of English thorough; I realized the power gained by an accurate and easy mastery of our own tongue, and I fully appreciated the æsthetic value of English literature in the cultivation of a refined and discriminating taste.

The constructive work was so managed that familiarity with composition preceded analysis, and the principles and rules of language were developed out of the pupil's own work. Grammar came out of language, not language out of grammar. The critical work of grammar and rhetoric was placed in the advanced course along with logic.

In this spirit, and by the general method here indicated, the whole course of study was arranged. The place occupied by each subject was not a matter of accident, but of philosophic dependence. The success of my scheme demanded intelligent and harmonious co-operation on the part of the faculty. I needed a select corps of teachers, and the freedom of choice secured to me by Mr. Monteith now proved of great importance.

For my first assistant I chose Prof. L. H. Cheney, who some years later was accidentally killed while making an excavation in connection with the work of a geological expedition under

direction of Prof. Shaler, of Harvard. In years long gone by Prof. Cheney had been a pupil of mine; later we had worked together, so that I knew well his peculiar worth and fitness for the place.

Next came Prof. and Mrs. Straight, representatives of the most advanced thought of the time in educational philosophy. They brought original and fruitful contribution to the work now in progress, and henceforth were to me as my right and left hand. At the close of his stay in Missouri, Prof. Straight was called to the charge of a department in the Oswego Normal School. Later he went with Colonel Parker to the Cook County Normal School, Illinois. He gave all the energy of an intense nature to his profession, but died in middle life, his mind a storehouse of educational material, ripe for use. Mrs. Straight's refined intelligence and professional skill found equally ready appreciation, and she took a high position in each of these normal schools. Since her husband's death, she has been called to a responsible position in one of the state schools of Japan. The remaining members of the faculty were chosen for their fitness in special directions. The plans of each had their recognized place in a co-ordinate work. One of the chief defects in colleges and academies to-day is this lack of co-ordination. Without it the scientific method in its integrity is impossible, and instruction proceeds as though each science were independent. Time and strength are laboriously frittered away, with the result of chronic discouragement on the part of both professor and students.

"I declare," said one of our most observant pupils, as he came out from recitation one day, "the teaching in all the classes is somehow alike! It makes no difference whether we are in natural science, mathematics, or language, we are going the same road, and each lesson throws a new light upon all the others."

When the summer school at Penikese was organized, we made prompt application for a share in the rare opportunities offered. Only fifty students could be accommodated. Three of our teachers received the appointment, and accompanied me across Buzzard's Bay on that eventful summer morning in 1873. Agassiz "the master" was there, his face hopeful and inspiring. The last and noblest experiment of his life was about to be tried, and everything promised success. The promise was fulfilled. The many summer schools of science, springing up all over the land, are the direct offspring of Agassiz's realized dream; and the increasing recognition of the fundamental value of science by numerous prominent schools is also largely a result of his Penikese experiment. Our teachers again, the second summer, made haste to profit by the advantages of the Penikese school, and returned to their work in Missouri with added skill and devotion.

Our pupils represented every class of society. We opened

with seventeen, and rapidly increased till the roll contained four hundred names. Within the limits of this paper only the bare outlines of our methods can be given. We began with the properties of things. The gardens and fields were open to us and furnished us the objects. When familiar with these and their relations, books were brought in to extend our knowledge beyond the limits of personal experience. The zoölogy and physiology classes, under Prof. Straight, were at once engaged in laboratory practice. They obtained their knowledge of the animal world from direct observation and through actual dissections. The neighborhood was laid under contribution for cats. Any feeling of repugnance at first shown for the work soon passed away as interest in the study grew eager and absorbing. The absurdity of rote-teaching was shown by an incident in the professor's classroom.

One day he called the attention of the class to the description of a certain sea-animal, as given in a popular text-book. This description he asked the pupils to commit to memory, which they proceeded to do, wondering why. One morning, only a few days later, the table was furnished with a specimen of this same animal preserved in alcohol. Not a member of the class recognized it. The elaborate verbal definition had given them no correct idea of the animal, if, indeed, any image whatever had been present in their minds.

In botany, books were unopened, except to aid in analysis. Materials for study the students found in their walks, and the keen delight awakened when examination revealed to them this new world of facts left no doubt that this was the very method of nature. The study went deeper than systematic botany, and led to an extended investigation of life processes in the plant.

Physics was taught in the laboratory and illustrated by apparatus which teachers and pupils united in making. This proved of double value; for, while primarily it helped to solve the problem in physics, incidentally it constrained the pupil to test knowledge previously gained by its practical application. The inventive powers were also stimulated, and a long step was taken in the development of faculty.

The teacher of geometry followed the method of Prof. Krüsi, of Oswego. This, in essentials, is the same as that outlined by Herbert Spencer in his work on education. It was developed incidentally out of the needs of constructive art, and was carried forward slowly, as the gradual progress of the pupil called for further applications of its principles. It was specially gratifying to witness the cheerful activity of pupils in this line of work, so often dreaded and shirked, and to watch the stimulating effect of power gained in mastering a difficult problem.

Drawing came in everywhere, being a mode of expression as natural as language, and indispensable to the acquirement of clear ideas; pupils soon made constant use of it, though, from lack of early training, their efforts had no pretensions to artistic merit.

Our lessons took various forms, depending upon the object we had in view. In the development exercises, by a series of questions quite in the Socratic spirit, we brought together the wandering, disconnected ideas which the class possessed upon any subject, and directed attention to the more obvious relations. The pupils were then left to work over the lesson, and arrange and present it in due order. This process became a guide, and pointed out the way for the next step in investigation. Lessons of instruction were usually given in the form of lectures. We, however, varied this exercise by substituting for the formal lecture a more or less familiar conversation, in which, after a little, all pupils took part.

Topical recitations included all knowledge obtained from books or reported from investigation. Day by day pupils were called upon to tell what they knew of given subjects in clear and connected discourse. The words of the text-book were not accepted; so every lesson became a language-lesson of the most practical kind. As a matter of fact, we found that, whenever a new thought was clearly understood, the mind sought expression in some form, either through constructive work, drawing, or language, and was not content until it had clearly imparted its meaning to another mind. The mental circuit was then complete.

In this reaching out after words and forms individual character asserted itself, the imagination was awakened, the invention quickened, and the dead monotony of the old-school recitation disappeared completely. This training finally resulted in an unusual mastery of spoken language.

Written work held a large place in our school. Our plan made provision for at least one written exercise a day for each pupil. As these exercises were in connection with the studies pursued at the time, the pupils entered upon them without any consciousness that they had begun the dreaded composition. Lessons from text-books, and aided by books of reference, were treated topically, and were frequently written out. Investigations in science were reported in writing, and in due time the pupils came to think easily and naturally, pen in hand.

In another regard we made a serious innovation upon custom. The teachers were not required to correct the wearisome mass of papers prepared daily. For this we had good reasons. The free use of criticism is a dangerous practice. It paralyzes the imagination of the pupil, and so depresses and discourages him that

original constructive work is next to impossible. And if, as so often happens through the training given, the critical faculty of the pupil is developed in advance of the constructive ability, and of the power to use language with ease and accuracy, the result is fatal to progress in composition. The first rude efforts fall so far short of the polish demanded by the critical spirit that the sense of discouragement is overmastering.

There is still another view of the case that makes for the same distrust of promiscuous criticism. The errors of the early compositions are soon naturally and spontaneously outgrown through the constant effort at clearness of expression, and through the rapidly increased power over language gained by this continuous practice. In this way the mastery of language came incidentally, and we avoided the stiff awkwardness of the conventional composition.

In the study of English we did what we could to awaken the literary sense to some degree in all our pupils. We knew that each one came into the world with definite mental limitations. The literary sense, like any other form of the artistic faculty, seems, with rare exceptions, to require several generations of culture in a scholarly atmosphere before it attains to a fine discrimination. But we could at least make a real beginning. We could find out the present state of their taste, and carry forward their development by guiding their course of reading. Advantage was taken of events to bring before them some special poem, or some impassioned prose composition, having relation to the event in question. We could thus awaken a susceptibility of the soul, that through repeated impressions would develop into an instinctive sense of the beauty of true literary art-forms.

This was our aim, and quite subsidiary to this was the acquisition of knowledge *about* literature. The history, bibliography, and philosophy of English literature must come later instead of usurping the first place, as is commonly the case in schools.

In language, Prof. Campbell prepared an exercise which proved of great value. He selected about three hundred of the most productive roots of English words, and gave them one by one to the class. They traced these roots back to the various languages entering into the English tongue, and thus acquired a broader view of the origin and relations of English words. The study thus bestowed upon the vernacular was further valuable as furnishing a basis for the study of other languages.

When the student in Latin, French, or German finds that a large number of the new words he is learning have the roots with which he is familiar in his mother-tongue, the difficulties of his work are greatly diminished.

Mental and moral philosophy were taken up objectively and

without the aid of books. Prof. Straight first developed the relations which knowledge sustains to mind, and the action of mind under varying conditions. He then took up some familiar subject and called upon the class to apply the knowledge thus far gained. For example, a flower was brought in and analyzed according to the laws of systematic botany. Then came introspection: what powers of mind had been used, and in what order? A lesson in geometry came next, and this was followed by the other school studies, until the list was exhausted. Next came the industries: what mental powers are brought into play in raising a crop, in building a house, in boiling a potato, in the making of bread? By this plan mental philosophy was lifted out of the fog of dreary abstractions and set on its feet in the broad light of every-day life.

Moral philosophy fell to my share. No books were used. My methods were quite similar to those of Prof. Straight. In a series of discussions, extending over several weeks, the human being was taken where Prof. Straight left him, and the relations developed that existed between him and other human beings. Needs were shown to exist by virtue of the "constitution of things," and deeper than this we did not attempt to go.

Human beings were seen to be *potentially* equal in needs, hence the necessity for equality before the law, that all might have opportunity for their natural development. Out of needs grew rights, and out of rights duties. A study of experience soon showed that duty assumed two phases—positive and negative. Confucius is credited with a maxim covering the ground of negative duty—forbidding injury to your neighbor; Jesus enunciated a law that summarized both positive and negative duty.

Next, the principles derived from this preliminary study were applied to the conditions which exist in school, home, and neighborhood. Why should a person work? What time should be given to recreation? What shall we do with the tramp? What with worthy but destitute men and women? What with needy orphans?

The discussion was conducted almost solely by the pupils. When it took too wide a range, the teacher quietly led it back to the question at issue. The lesson on one occasion dealt with card-playing. One young woman charged that it led to gambling and bad company. To this another replied that she had often played but never for money, nor had she the least inclination to gamble. As for bad company, she played with her sister, who was no worse company at the card-table than at the dinner-table. When I found that the discussion had become a mere assertion of opinion, I interposed: "You seem to disagree. Why?" "Yes," said one, who recalled my method of treating such cases, "we have

not facts enough to enable us to form an intelligent opinion." "But," said another, "what is your opinion?" "My opinion is not the question. What are you to do next?" Wait, observe, and continue to study, was the conclusion.

Our history grew out of our geography, and, as we labored to build up in the mind of the pupil a connected and distinct picture of the skeleton—the mountain system of the globe—and then clothed these gaunt outlines with the trailing robes of continental divisions, showing also the necessary dependence of the water systems upon the great backbone of the continents, so in history we aimed at a unity of conception, we sought to develop an historic sense, which, once acquired, serves as a guide through the mass of unrelated facts filling so large a space in historical works, even of the higher order. This kind of training is too complex for description here.

And so of our methods of discipline: they were all intricate and intimate parts of our whole work. We had no rules, no class-markings, no roll of honor. We rejected the whole military system, as tending to produce mechanical, routine work. The abrupt tone of command was not heard within our walls. Directions were given in the form of requests. Teachers and pupils observed toward each other the usual courtesies of social life. No premium was offered for study. We relied on the natural incentives. Exercise of faculty is the chief source of pleasure in the young, and we furnished abundant scope for it. The time being filled with pleasurable occupations, calling into activity the whole nature, there was less temptation to misdemeanors than in the ordinary conditions of home-life.

Herbert Spencer's essay on moral education will best describe the work as it went on in our school, subject to the imperfections of human nature it is true, but with a result in general most gratifying.

The school as a whole soon attained a character of its own, derived from the aggregate of its members, and, reacting upon them, it became a potent force in stimulating the moral growth of individuals. This aggregate moral power was exerted for the most part unconsciously, but it was effective, and in time reached proportions which rendered my interference unnecessary.

An incident will here illustrate the operation of this power. A youth entered our school who had formerly been employed as train-boy upon the railroad. His experiences had greatly sharpened wits naturally keen, and as he came among us he was plainly seen to be an alien element. His evil propensities soon showed themselves. He told foul stories, but could get no listeners. He tried to pick quarrels with the younger members of the class, but a quiet word from one of the older pupils soon put an end to

that; and, finally, he became angry and disgusted, and took himself away permanently. I watched this affair with much interest as a psychological experiment, but with some anxiety lest the moral leprosy should spread; but the character of the school told, and I was superfluous.

Another instance discloses something of the spirit prevailing among our students. The use of tobacco was discouraged incidentally in a variety of ways. We had a beautiful new building, and great care was taken to preserve it free from filth of any kind. A tobacco-stain, when observed, was removed at once with scrubbing-brush and sand. The physiology class, too, came upon the question of the action of tobacco upon the tissues of the body, and, besides, there was felt to be a social discredit in its use. One evening, while waiting for the mail at the post-office, a number of students on the same errand gathered about, and our talk turned on school matters. Allusion was made to our freedom from the restraint of rules. A late comer remarked: "But you have one rule, I understand. No one must use tobacco on the school premises." I assured him that, though I was opposed to the use of tobacco, I did not prohibit it. "But," I said, "no gentleman will soil the floor of a room occupied by ladies; and this fact, being understood, prevents its use more effectually than a positive prohibition." So powerful was the social reprobation of this filthy habit, that forty young men, of their own will, gave up the practice. It will thus be seen that our moral training, too, was largely incidental; it was implicit in every detail of school-life.

As will already have been anticipated, we dispensed with all distinctive religious services. I had carefully observed the effect in school and college throughout a long period of years, and had been forced to conclude that the evil results vastly outweighed the good. I had noticed that stated Bible-reading often became a mere lifeless form, in which many took no interest. This was contrary to the whole spirit of my system. "Vain repetitions," leading to a habit of regarding words apart from thought, were to be carefully avoided. Then, again, the teachings were dogmatic, appealing to authority, while science regards authority as an impertinence. Besides, the Constitution of the United States places its whole machinery upon a strictly secular basis, and religious services in a State school are there upon sufferance. No matter how carefully guarded, the daily performance of any religious service degenerates into formalism, and excites in the community sectarian animosities.

But, above all, I wished to place morals upon a scientific basis, so as to furnish a safe guide to conduct, independent of the shifting standards of theological belief. We, who received our appointments from the State, could not, honestly, either promote or

attack any form of religious belief. Happily, the scientific method equally forbids doing either of these things, and, if strictly adhered to, will prevent all possibility of such quarrels between religious sects as have recently agitated Boston, and have from time to time interrupted the work of many schools in this country.

Our position on this question occasioned wide-spread comment, and, among the clergy of the more ignorant and bigoted sects, there arose an opposition, instinctive rather than outspoken.

The Missionary Society voted us a Bible, and I received a formal note from the secretary announcing the fact, and requesting me to appoint a time for the presentation to take place. I had been informed privately that, as soon as I fixed the time, a public meeting was to be called, and an address made denouncing our neglect of religious observances. In answer to the secretary, I informed him that our library was richly supplied with Bibles, but that, as a token of confidence and good-will, their gift would be highly prized, and we would gratefully receive the promised Bible at the president's office in the normal-school building, at such time as was most convenient to the secretary. The Bible never came.

Prof. Campbell, of our faculty, gave testimony of considerable significance concerning the moral atmosphere of our school. He had been educated in a sectarian college, and had been graduated at a theological seminary. All his prejudices were enlisted in favor of a daily religious service. He said: "I am at a loss to account for the uniform good feeling existing between teachers and pupils here. No student seems disposed to annoy or vex a teacher, and the moral tone of the school is much higher than I have before known." At first, he had thought that the good-will prevailing was in spite of the omission of religious services, but a more careful study had convinced him that the system, in its integrity, had created the moral atmosphere that pervaded the school.

Examinations, as usually conducted, had proved fruitful of serious evils. They gave opportunity for cram, and were often an occasion for cheating. When formal and stated examinations are held, on which class promotion depends, there is a strong inducement to make spasmodic efforts of memory serve in place of sound learning. We avoided these evils by a simple device. Examinations were held at irregular intervals, and were of such a nature that no miraculous feat of memorizing could meet our requirements. Repetitions of text-book formulas were habitually in disfavor, and necessarily there grew up habits of genuine study. These reviews were found sufficient aids in testing progress, and we dispensed with all other examinations.

After some effort toward conformity to prevailing custom, we found ourselves constrained by the guiding principles we had adopted to devise some more genuine representation of our year's work than is possible in "closing exercises" of the regulation pattern. Essays upon the subjects usually chosen had no essential relation to the student's past researches, and, being prepared for the occasion, represented nothing in particular. Besides, they are not uncommonly doctored by the teacher of rhetoric till they are of doubtful originality. We finally dispensed with all special preparation, and discarded all the spectacular features of the ordinary commencement.

One day was given to the public. Every four weeks during the year our pupils had been accustomed to select some subject having close relation to their studies, and to give time and care to the preparation of an essay upon it. These papers were preserved, and from among them each member was required to choose and bring one. On the last day of the term the public came in, and those interested stayed and listened to the reading of these essays. The truthfulness of every step was plain to all concerned, and was thus in accord with the spirit of the school.

Our experiment came to an end. Of the various innovations made upon custom each had justified itself. The effort to make character the end of education had more than fulfilled expectation. During the last year not a single case of misconduct was reported to me, nor was the behavior of one of our students criticised by the citizens. We had a reign of influence. The forces that govern conduct came from a growth within of just and kindly impulses. A watchful supervision had always been maintained, but into this had entered no element of espionage. The peculiar character which the school attained, both on its mental and moral side, was due to the several factors of influence—scientific methods in study, philosophic succession of subjects, and a never-ceasing but an apparently incidental attention to moral training.

Through the strong personal influence of the State Superintendent, Hon. John Monteith, my independent position had been maintained. I had enjoyed entire freedom in the management of the school and in the selection of teachers. During the three years of my stay in Missouri, educational affairs were in a transition state. At the close of the war, the public-school system was organized and protected by constitutional provisions. The best results of Puritan experience for two hundred and fifty years were incorporated in its provisions, and made secure so far as legislative enactments could compass it. More progress was made in the State during the few years of the so-called carpet-bag rule than in all its previous history. A State Board of Regents,

non-partisan and largely professional, were in control throughout our first year. But the rebels were enfranchised, and reaction at once set in. The State Board was abolished, and a local board created, by its very constitution hostile to ideas.

Naturally, personal and sectarian interests would find expression. Members of the local board could see no reason for holding the office, when their functions were restricted to paying over money into the hands of Yankees, to be largely spent in the East during vacation.

Of the special influences that finally brought our experiments to a close it is unnecessary to speak in detail. Suffice it to say that our chief opponent stood before the people as a representative of wealth, and as the most prominent supporter of all religious enterprises. But below the sanctimonious exterior were the predatory instincts of the barbarian. His betrayal of trusts, his flight from outraged justice, his disappearance in the wilds of the Far West, his discovery at a lonely wayside inn, on a road leading to a mining-camp, prostrated by illness, without help, and hunted to the grave by detectives, afford a spectacle so gloomy that even retributive justice is shocked at the recital.

Recent experiments, introducing as we did the constructive arts as a means of expression, have again demonstrated their educational value; and I am persuaded that some time in the future the scientific method, with its freedom from arbitrary restraints, its ethical aims and accomplishment, will in its completeness take control of our leading educational institutions.

UNDERGROUND WATERS IN ROCK TRANSFORMATIONS.

By Prof. G. A. DAUBRÉE.

EVIDENTLY different actions from those which engendered the metalliferous deposits have propagated themselves through considerable masses, and have impressed a peculiar stamp upon them. The rocks that have been marked by such actions exhibit at once the characteristics of the sedimentary rocks and some of those of the eruptive rocks. While retaining the stratified disposition which they owe to their sedimentary origin, they are often studded with crystalline and anhydrous silicates, which they would not have contained if they had continued in their normal state. These rocks, of a somewhat mixed nature, are called metamorphic, a term given in allusion to the changes which they have undergone since they were deposited, and to which they owe their present appearance.

Stratified rocks have sometimes acquired these characters in the vicinity of eruptive rocks. In several localities of the Tyrol, the Triassic limestone in contact with melaphyre has been transformed into white marble for a thickness of more than five hundred metres, while pyroxene, spinel, tourmaline, and other crystalline minerals have been developed at the same time.

Clay schists have suffered mineralogical transformations in proximity with granitic eruptions. Even half a century ago, De Boblaye pointed out the presence, in Brittany, of fossil shells among the schistose rocks, which also contained, in testimony of the heat to which they had been subjected, large crystals of silicious minerals, as of andalusite or macle, and staurotide. The groupings of the latter species in the form of a cross have been long remarked, and have caused the name of *croisette* to be given to it. These remarkable modifications of the schists, which constitute a sort of radiation around the granitic flows, extend to distances varying from a few hundred metres to three kilometres. The heat to which the strata have been subjected by the intrusion of the eruptive mass is undoubtedly one of the causes of it; but the watery emanations which accompanied the eruption of the granite, and which are revealed to us by inclusions in the mass, attest that water has played a no less important part in it.

There is, however, something still more remarkable than this in the phenomena of metamorphism. Sedimentary rocks, occupying whole regions, bear evidence of profound modifications, without its being possible to discover the slightest eruptive cropping out. One of the most common examples of this phenomenon is that in which clay rocks have become phyllads. The rocks of that name, although they consist essentially, like the clays, of silicates of alumina, differ from them in their cohesion. They refuse to mix with water. The strata of the Ardennes, the Taunus, and other regions of western Europe, in which this mineralogical condition was first verified, belong to the most ancient geological epochs; and from that fact this crystalline texture was for a long time regarded as exclusively appertaining to sedimentary deposits of a very remote age. Hence the name of transition beds which was given them. It was thought that in the sea in which these matters were deposited, following the primitive or crystalline beds, there continued to operate a chemical precipitation of silicates which were mingled with arenaceous and calcareous deposits. It was subsequently recognized that this half-crystalline condition resulted from a transformation posterior to sedimentation.

The opinion that the mineralogical condition of these beds is not a necessary consequence of their antiquity, receives confirmation from the fact that formations in other countries, also belong-

ing to the most ancient systems, do not participate in these crystalline characters, but in their argillaceous rocks are similar to those which are found in recent formations. This is the case in Sweden, Russia, the United States, and Canada. But it has been observed in those places that the strata have not been strongly dislocated as in the regions we have just been speaking of, but have retained their original horizontality. To this circumstance they doubtless owe their preservation. The mineralogical contrast between formations of the same age corresponds, therefore, with an essential difference in their bearing.

There are countries where formations of less antiquity have also suffered profound transformations. The Alps afford fundamental data on this subject. In the face of the rocks of different ages—Carboniferous, Triassic, and Tertiary—which enter into their composition, one is surprised at the special physiognomy which each one of them presents as compared with what we observe in beds of the same age in other regions, where they have remained horizontal. A general influence has, therefore, acted upon a part of the vast region of the Alps. It has affected rocks of every epoch, even those of the Lower Tertiary—that is, a series of beds many thousand metres thick—and that, although eruptive rocks are very rare in it.

With the mineralogical changes which we have just noticed is associated a modification of texture that depends on the same cause. It is well known in the slates as the schistose or laminated structure. The fissile rocks which it characterizes have the property of detaching themselves in thin plates—that is, of cleaving in certain directions. Observations made in various countries have demonstrated the important fact that the planes of cleavage are quite distinct from the planes of stratification. Instead of being parallel to the layers, they are frequently oblique, and—what is still more conclusive—while the planes of stratification have been bent and exhibit a variety of inclinations, the planes of cleavage pursue a regular direction, regardless of the most pronounced inflections, and remain constantly parallel to one another. This independence shows, besides, that the planes of cleavage were produced, not only after the beds in which they are manifest were deposited, but also after they had lost their primary horizontality. The schistose disposition, very frequent in the most ancient fossiliferous rocks, sometimes persists in more recent formations, when they have been subjected to energetic dislocations. In many localities of the Alps slates are quarried into the Tertiary formation.

An important characteristic of the schistose rocks is the considerable deformations which the fossils in them have received, as is seen in the trilobites of the Angers slates. Not less fre-

quently, the molluscan fossils called belemnites have been broken up and had their segments more or less scattered.

Since the schistose structure has been found to be independent of the stratification, the cause of a geometrical disposition so remarkable and so general has become the subject of various hypotheses. It has been successively attributed to electric effects, to terrestrial magnetism, to the heat of the globe, and to a beginning of crystallization. Exact observations, however, teach us that the cleavage of stratified beds is related on the one hand to the actions which have deformed the fossils in the same strata, and on the other hand to the axes of the warping and the great lines of dislocation. The phenomenon should most probably be attributed to mechanical action.

The demonstration has been confirmed by some very simple experiments. Clay under compression assumes a leafy texture; but, for this, it must have a certain degree of plasticity. If too dry, it crumbles; if too wet, the laminæ, while they are formed, are not separable. I have got more decisive results from forcing clay to flow, in a jet, under hydraulic pressure. In this case, very well defined leaflets are produced, and that upon bands of several metres, in the direction of the pressure and the movement. All of these artificially laminated pastes resemble natural schistose rocks in their fracture. In these various flows of the plastic mass, the neighboring particles do not advance uniformly. The differences in the velocities which they acquire cause them to slide upon one another; and the schistose texture, the direct consequence of this sliding, is, we may readily conceive, necessarily determined in reference to the direction of the flow. The deformations of fossils and the drawing out of belemnites have been reproduced in this way, and thus experimentally explained.

We shall now consider how the fundamental facts of metamorphism imply the necessary action of subterranean waters. The mineralogical modifications peculiar to the phenomena have incontestably taken place at a higher temperature than now prevails on the surface of the globe. We base this conclusion upon the analogies of these beds with the eruptive rocks, and especially upon the presence of numerous anhydrous silicates, which form one of their most remarkable features. The proper heat of the globe decreasing from the deeper parts toward the surface, the sediments deposited in the ocean, at the relatively low temperature that reigns there, should, when they have been covered by other strata, acquire a higher temperature by reason of their greater distance from the radiating surface. The superposition of masses as heavy as are those of some of the stratified beds has often been enough to determine, after their deposition, a considerable heating up of the lower masses, especially at periods when

the increase of heat downward may have been at a more rapid rate than now. Thus the regular propagation of the heat of the globe has been competent to act upon entire formations.

There is, however, another source of heat, at once more immediate and more energetic, for the transformations with which we are occupied, although it has been long misunderstood. Heat is engendered by the mechanical actions that have left their marks at numerous spots on the crust of the globe. Instead of preserving the horizontal position which they assumed when they were deposited, these beds have often been thrown up, folded, and contorted in various ways; and the resultant dislocations are observable through several thousand metres of thickness. At every step, in the Alps, for example, in the face of escarpments where the rock shows itself to the quick, the least observing eye is attracted by the boldness of the inflections, and the mind pauses stupefied before the grandeur of the forces that have produced such effects. Not all the labor put in play in these colossal upthrows has been employed in actions purely mechanical. A part of it has been transformed into heat, and it is the effects of this heat that we have been studying.

Experience has come to confirm the last induction also. Clay has been forced to flow either between cylinders like those of iron-rolling mills, or under trituration in malaxating tubs, such as are used in some brick-yards. In either case the rock is considerably heated up after a very short time, without subjecting it to any material pressure. In these operations the heating is greater in proportion as the clayey part is harder and more resistant. We have then reason to believe that in nature, when rocks more coherent and less plastic than ordinary clay have been submitted to mechanical actions powerful enough to determine an interior movement, even if it be of little amplitude, they will be found in conditions still more favorable to their being heated. It has, therefore, been enough for argillaceous masses to undergo a lamination under the effect of dislocations in the crust of the earth for their temperature to be notably raised.

But heat alone, however intense it may be, can not explain the most characteristic effects of metamorphism, nor the uniformity with which they have been produced over considerable spaces; for the conductivity of the rocks is extremely weak. Then, contrary to what would be the case were the action simply a calorific one, the effects have not always been most energetic in the parts in contact with the eruptive rocks. The water included in all the rocks, whether in their pores or in combination, has of necessity intervened as an auxiliary to the heat. The nature of the minerals produced, of the hydrated silicates, like chlorite, for example, no less than the uniformity of their disposition in vast masses,

denote the intervention of this interior water. Thus, in this order of geological phenomena, when we might have believed that heat, accompanied by certain chemical actions, was the sole agent, subterranean water has also had its part to play.

This conclusion regarding the fundamental cause of metamorphism, although it had been justified by observation, still needed an experimental sanction. For that, the investigator should put himself in circumstances as nearly as possible like those in which Nature seems to have acted, and obtain the reproduction of characteristic minerals. I have tried to realize this. The principal difficulty in operating under the enormous pressure acquired by the vapor of water when the temperature approaches the point of dull redness is to find walls capable of resisting it. Water having been placed in a glass tube, which was then sealed by a lamp, this tube was introduced into a second tube of iron, with very thick walls, which was also closed, but not without difficulty, at the forge. In order to counterbalance the tension of the vapor in the interior of the glass tube, which might cause it to burst, care was taken to pour water outside of this tube, between its walls and those of the iron tube. The apparatus was set upon the dome of the furnace of a gas-factory in contact with masonry at a dull-red heat, in a thick bed of sand, where it remained for several weeks. Under these conditions, explosions of extreme violence took place. The most strongly resistant tubes were thrown into the air, bursting with a noise comparable to that of a cannon-shot. It was not possible to multiply the proofs to the extent that was desirable; but those that were made were sufficient to reveal facts quite different from those which we had deduced in laboratories under ordinary conditions.

The water acted very energetically upon the glass, which underwent a complete transformation, in composition and appearance. It was replaced by a white mass, quite opaque, resembling porcelain, with swellings and blisters, the results of softening. There had been developed, at the expense of a part of the substance, numbers of minute crystals, colorless and limpid like rock-crystal, with which they are identical, even to small details in the forms. These artificial crystals appeared, now isolated, now grouped into geodes which it was impossible to distinguish, except for the difference in dimensions, from those of nature. Another product of the same experiments deserves no less attention. It is pyroxene, which appears in little green, brilliant, and transparent crystals, exactly like those of the Alps. For the first time an anhydrous silicate had been seen to be produced by the action of water.*

* More recently, feldspar has been imitated, under similar processes, by MM. Friedel and Sarrasin.

The acquisition of another kind of power by water under such conditions was exemplified by the conversion of pine-wood into a bright and hard black substance resembling anthracite, and consisting simply of carbon associated with small quantities of volatile substances. It was shown, by its granulation in small globules, to have passed, in the water, through a kind of fusion, The reactions from which these products resulted are all the more interesting because they were obtained with a very small quantity of water, hardly equal to a third of the weight of the metamorphosed glass. Furthermore, the new products crystallized at a temperature considerably lower than their point of fusion. It is thus proved that water highly superheated acquires an energy that was unknown to belong to it. It destroys combinations that were reputed to be stable, and in the presence of which it was regarded as inert; and it composes others, among which are the anhydrous silicates. The production of these silicates in the crust of the earth escapes our observation, because it requires a temperature greatly superior to that of boiling water. But it must be going on in the depths of the rocks, where there is no lack of imprisoned water, nor of temperatures and pressures incomparably higher than those of our most potent experiments. It is hardly necessary to say more concerning the application of these synthetic results to questions concerning the metamorphic transformation of entire regions.

Other facts in nature are explained in these experiments. First, they teach us the origin of quartz in the crust of the earth, where it appears everywhere and in the most diverse bearings. Have not the veinlets of this mineral, for example, which traverse quartzites and phyllads in every direction, probably separated themselves at the expense of the incasing rock, and in the presence of water and heat, just as the quartz was extracted from glass? An action of the same kind is recognizable in the metalliferous veins. Sometimes the temperature there is high enough for the silicates also to be generated. The veins in which the green emeralds of Peru are found associated with crystallized quartz, calcite, and pyrites are evidently of aqueous formation.

Thus, by going back to ancient periods, we have seen how numerous species of minerals are produced concerning whose origin the observation of facts occurring to-day can not inform us. These numerous minerals, whether metalliferous or stony, occurring in various formations, are the final result of the work of water, which is found in some way stereotyped in them. We have thus succeeded in discovering the intimate operations of that liquid in laboratories which it abandoned long ago, in fissures of greater or less magnitude, and in blisters or the simple pores of the rocks. We are instructed concerning the manner in

which it circulated, by vestiges of different kinds which permit us to reconstitute the various circumstances of its course.

The external features of an organized being make its constitution known only in an incomplete manner. An adequate anatomical study must penetrate to its interior organs and tissues. Thus, existing thermal springs, even if we take care to scrutinize in the most careful manner the constitution of the country and the conditions where they issue, do not suffice to reveal their economy with precision. Their constantly flowing columns of water, even when they are not accompanied with irrespirable gases, prevent our reaching their channels of ascent. In the very exceptional cases in which it is possible to penetrate below their orifices of emergence, as at Bourbonne and Plombières, the curious facts which we observe cause us to regret that we can not descend lower. Nature seems to have desired to withdraw from our sight the actual workings of subterranean waters, especially when they are engendering minerals. Water is not more rare than heat in the masses of the interior of the globe. Even when it does not circulate in natural channels, it is at least present, held imbibed in the most compact rocks. In clays, although combined, it is not less susceptible of acting chemically than in the free condition. Thus, what we have obtained only with many difficulties in our experiments, the action of superheated water, is found vigorously exemplified everywhere in the interior of the rocks, where the effective resistance to enormous pressures permits the realization of more complete results than are possible with the fragile apparatus of our laboratories.

The circumstance that heat stored in masses of so little conducting power as stony substances is preserved for a very long time, is eminently favorable to chemical combinations and to crystallization. Nature possesses another superior advantage over man in having extremely long lapses of time at her disposal. The importance of this advantage, in the application in which we are now regarding it, appears plainly from what has occurred in the Roman masonry of Plombières. Besides this, reactions which go on slowly do not require so high a temperature as those that are of shorter duration.

The study of waters in their course and effects in ancient epochs thus seems to complete the history and broaden the view of their subterranean works. Here, then, a real exchange of light takes place. The past illuminates the present as much as the present illuminates the past. There is nothing, moreover, to prove that phenomena of this character do not continue down to our own days. We have a right to believe that similar actions are still going on, but in interior regions beyond the reach of our powers of observation. Superheated water, which betrays its ex-

istence through thermal springs and volcanic exhalations, to all appearance is slowly and silently engendering considerable and permanent effects in the interior of the globe, and is giving birth to various minerals as it did in former days.

In the same way as in our organism all the parts of the body owe their development to the support which they receive from the circulation of the blood, so in the crust of the earth, water, by its incessant subterranean circulation and its predominantly chemical work, accomplishes a kind of vital action which is perpetuated through ages. May we not justly apply to these mineralogical and geological results, so worthy of our curiosity and derived from a single cause, Leibnitz's favorite epigraph, *In varietate unitas ?—Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

THE ORIGIN OF HOLIDAYS.

By HARLOW GALE.

AS ballads are the essence of a people's history, so holidays are the free utterance of their character. Spontaneity is always valuable evidence, and holidays are in their beginnings purely spontaneous. They furnish psychically an excellent example of reflex action. The stimuli which come to us from the outer world of things as well as from the inner world of sensation find three channels for the expenditure of their force, viz., thought, feeling, and involuntary or reflex action. Man's position in the scale of life is determined in general by the proportion in which stimulus is distributed among these three outflows. The less of conscious life a creature has, the nearer will it approach to the existence of an automaton.

Now, though we can not precisely construct the psychical life of the primitive man, yet the law of evolution enables us to picture him as exercising little reflective thought, rather dull feelings of the bodily pain and pleasure sort, and a comparatively large amount of reflex action; so that stimulus, following the line of least resistance or greatest traction, will in a majority of cases end in reflex action. Even if the incoming sentient current does flow on or over into feeling and even thought, the smallness of their capacity prevents much egress through these intellectual channels, and the restricted current must again find its exit in expressive muscular action. Let us briefly review the historical beginnings and development of this spontaneous demonstrative life.

The primitive holiday was occasional—i. e., prompted by unusual events of domestic or tribal life. Births, marriages, and deaths are almost universally celebrated by primitive man, and

we must remember that his feelings connected with death are by no means such as ours. Though the pains of separation and loneliness have come to be widely differentiated from those joyful, generous feelings connected with the beginnings of domestic life, yet with the savage it was more fear than affection which prompted the propitiation of the ghost of the dead, and a gift of presents for its use in the future world. The Pacific islanders, Asiatic peoples, African tribes, and American Indians, all, in one way or another, feast and sacrifice on occasion of the principal family events. Among the Karens a corpse lies in state three or four days, amid marching around to music of pipes, singing, lamentation, and athletic games. The Javanese have religious festivals for marriages, births, circumcision, and for the dead. The Tongans celebrate their chief's marriage by dancing, single combats, boxing, and wrestling. On the birth of a child the feasting, sham fighting, night-dancing, etc., last for several days among the Samoans.* The principal friends of newly made parents among this same people bring presents on the third day after the birth of the child, according to an invariable rule, by which the husband's relatives bring pigs, canoes, and foreign property, and the wife's relatives bring fine mats and native clothes made by the females. These interchange their gifts and leave the parents as poor as before. The Malagasy's ceremonies, bull-baiting, dancing, singing, beating of drums, etc., at circumcision, last a week or even months. The Hottentots have feasts of eating, drinking, and smoking on the admittance of youth to manhood and womanhood, and on occasion of marriages and funerals. On the death of a king of the Congos † no work must be done, the natives stay at home, while the fields remain uncultivated for a month. A king's death among the coast negroes, Ashantees, and Abyssinians, however, is the signal for general lawlessness and plunder. The destruction of property, feasting, and sacrifices at an ordinary funeral often ruin one of these families. The celebrations of the Santals are few and simple: at admission into the family, tribe, and race; at marriage, divorce, cremation, and the reunion of the dead with their departed fathers. The funeral games of the Kirghiz are racing, wrestling, and trying to catch a coin out of a vessel of sour milk.

Coming to higher types of men, with more social and political coherence, the number and variety of festivals increase. They cease to be held for domestic events alone, but are extended to such tribal matters as, among the Abipones, councils of war, im-

* Spencer's "Descriptive Sociology," No. III, Table XII, p. 27, "Lowest Races, Negrito Races, and Malayo-Polynesian Races."

† Spencer's "Descriptive Sociology," No. IV, "African Races," Table XXIV, and page 18.

pending fights, victories, birth of a chief's son, change of name (done at funerals), arrival of distinguished visitors, or the proclamation of a new chief. Among the Malagasy a grand feast, accompanied with dancing, music, and sports, terminates the ceremony of a treaty. The Mandans * hold a feast of the bull-fight, on which depends the coming of their supply of buffaloes. Two feasts are given by the Hottentots at the installation of a chief of a kraal: one by the person installed, when the men eat all the meat and give the broth to the women; and the second, given by the wife, when the women get the meat and the men the broth. The New-Zealanders give great feasts and Olympian games to other nations. In their national pride to outdo each other in prodigality the collection for these feasts is begun a year before, and the extravagance often produces a famine, so that the natives are obliged to leave their settlements till their crops are ripe. Cannibalism is simply the Fiji style of an occasional feast. Before going into war the Tahitians offer human sacrifices; and at the coronation of their king there is a great religious festival in honor of the monarch, whose girdle of red feathers identifies him with the gods. Different districts among them challenge each other to public games, e. g., wrestling, boxing, foot-racing, canoe-races, spear and javelin throwing, military and naval reviews, ball, archery, cock-fighting, surf-swimming, kite-flying, etc., all of which are also often connected with religious ceremonies or a cause of national rejoicing, such as the return of a king or the arrival of some distinguished visitor.

The transition from occasional to periodic festivals is through the various harvest celebrations. The Congos have a great harvest feast at the ripening of the yams, and the Ashantees celebrate the same event with processions and sacrifices of slaves. Sacrifices are made to the late village head of the Santals, at each stage of rice-planting. Three great festivals are held by the Gonds—at seed-time, at harvest, and when the mhowa flowers. A feast is also kept at the end of a monsoon to the god of rain. The Creeks have a religious feast of four to eight days on the ripening of the crops. A feast of first-fruits is held in January by the Kaffirs. At the sowing of the rice the Dyaks have three festivals: in the midst of the cutting down of the jungle, when it is set on fire, and the blessing of the seed before planting. At harvest are three more: feast of the first-fruits, of the middle of the harvest, and to secure the price of rice.

The next stage in the development of our ancestral holidays is one of great importance. In this one primitive astronomy begins, our calendar has its genesis, and domestic, civil, and political life begins to assume something of that order and regularity which

* Spencer's "Descriptive Sociology," No. VI, "American Races," page 17.

inspires confidence between man and man, and gives stability to customs and institutions.

We can hardly appreciate the meaning of the appearance of the new moon to the primitive man. It was the herald of a new season of light to dispel his natural dislike and even fear of darkness. The old Hindus and the Arabs through the Syrians sacrificed at new and full moons. The Tasmanians danced at full moon. One of the earliest recorded festivals of the ancient Hebrews is that of the new moon. This event was regularly celebrated by the chief of the Nootka Columbians, by causing a slave to be killed to furnish a banquet, amid songs and dancing, to the other chiefs of lower rank. A certain phase of the moon was also the most frequent natural periodic event to suggest the memory of events celebrated at the last moon, and were this memory vivid enough the savage would be moved to renew his demonstrations. The Uaupés laments his dead from the time of death to burial, and follows this with an Irish wake. Then a lunar month after death the corpse is disinterred, roasted in a pan, the remaining black mass is powdered, mixed with drink, and drunk. The funeral wake among the Abyssinians is held some months after the funeral.

When man's memory grew stronger with his development, the natural solar divisions of time acted as stimuli on his mind to commemorate festival events. The ancient Peruvians feasted each month of the year, but had their principal feasts at the solstices and equinoxes. To the Sol grove, the abode of the family gods or deceased ancestors, the Santals repair yearly, to worship with dancing, music, chanting songs in memory of the founder, and to hold sacrificial feasts of goats and fowls. Each family danced about the tree, supposed to be the abode of its own god. The Karens* have an annual feast of the dead at a new moon, when the deceased are supposed to be present, and partake of the food and receive addresses. Among the Kalmucks four yearly feasts are held: (1) New-year's, lasting for several days, with feasting and good wishes. (2) Summer festival, with wrestling, horse-racing, etc. (3) "Consecration of the water," when bodily and spiritual ailments of the bathers in the water were cured. (4) "Candle festival," at beginning of winter, when lights are lit in the temple. The most important and popular feast among the Malagasy is the New-year, or "bathing," that being the principal part of the ceremony. Ten or fifteen thousand bullocks, however, are usually killed at this time, and sacrifices are made to the gods and at the tombs of the king's ancestors. The funeral ceremonies of the Todas are usually celebrated annually by feasting,

* Spencer's "Descriptive Sociology," No. V, "Asiatic Races," Table XXXVII, and page 23.

dancing, and slaughtering of animals. Among the Arabs there is an invocation of the dead, and sacrifices at the tombs of the chiefs once a year. The Eskimos hold religious feasts about the winter solstice and at New-year's. A yearly celebration of a tradition of a deluge is observed by the Mandan Indians. Among the ancient Phœnicians mourning rites were repeated annually.

We come now to consider how the more or less artificial subdivisions of time came to be used for periodical celebrations, and ultimately became fixed holidays. There appear historically arbitrary days, such as the three post-natal feast-days given by the Gond mother. On the fifth day after the birth of her child her female friends are feasted, male friends on the twelfth, and both together again on the thirteenth. Such an arrangement of dates is probably determined by the physical state of the mother and some conditioning social customs. It is by division of the lunar month, however, that the development continues among the more civilized peoples. A triple division in Tibet gave their original fast-days the 9th, 19th, and 29th; the Mongols, having fixed temples far removed, held three successive days, the 14th, 15th, and 16th; those of the Kalmucks are the 8th, 15th, and 30th. But, when the old Hindus, Arabs, and Syrians sacrificed at new and full moons, the beginning was made toward the Jewish Sabbath and our Sunday. The fourfold division of the lunar month by full and quarter moon religious or sacrificial feast-days gave the week and the magic number seven. With the Babylonians, the 7th, 12th, 21st, and 28th days of the month were called days of "sulum," or rest; certain works being forbidden on these days. This expression was transmitted from the older Accadians. Each of these days was consecrated to a different god, one of whom was the moon. Whether the Congo negroes got their frequent Sunday by a sevenfold division of the month we can not say positively, but it is certainly very significant that every fourth day is with them a general day of rest from work in the fields.

This process of subdivision is especially interesting to trace in Semitic and Jewish history, for it shows the perfectly natural rather than the supernatural origin of our "day of rest." The month is the old sacred division of time common to all the Semites. The Mohammedan and Jewish calendars are still lunar. The Semitic word "ahalla," meaning "to greet the new moon," was used of any festal joy, and became the type of religious festivity in general. "In the old Semitic scriptures the new moon and the Sabbath are almost invariably mentioned together." There were the same occasional feasts which we have found in the life of other barbarous peoples, much the same equinoctial, solstitial, and yearly festivals, so that the permanent subdivisions of the lunar

cycle by a ceremonial and emotional race was a most natural progress of their enlarging life. At the middle of the tenth century B. C., there were, besides the annual feasts of unleavened bread, harvest, and ingatherings, those of the new moon and the Sabbath; and these latter still retained their primitive characteristics of joyful days of rest and assembly. In fact, owing to the popular reluctance to class religious days, and particularly the ancient Sabbath, as holidays, "we can not refrain," with Deutsch, "from entering a protest against the vulgar notion of the Jewish Sabbath as being a thing of grim austerity. It was precisely the contrary—a day of joy and delight, a feast-day, honored by fine garments, by the best of cheer, by wine, lights, spice, and other joys of pre-eminently bodily import." So here the same objection should be met which was anticipated in the case of funeral ceremonies and festivals. All primitive religious ceremonies and days, whether they be in connection with ghost, fetich, or Nature worship, are of this spontaneous emotional character which is the essence of holidays. It is doubtless true that, when in the course of the development of a religion the spontaneity lessens, and with more expressionless feeling and calm thought the religious life of a people crystallizes into mechanical forms and creeds, then austerity and asceticism have dried up the holiday heart in church-days; but when the reaction comes, and the Church in fear and horror calls us to defend her acquired prerogative, we are assured, by such an inquiry into the origin of her days, that either the creeds and commandments must be periodically modified to the needs of human nature, or that mankind will find more radical vents for its spontaneity. The founder of Christianity saw the necessity in his day for the rebuke that "the Sabbath was made for man and not man for the Sabbath." We to-day see that man has made his own Sabbath; being his own, he must not and can not be kept from his heritage.

This suggests the question, How has the direction of holidays come to be taken from the hands of the participants? The answer is obviously found in the course of differentiation and specialization which holidays have undergone. The domestic festivals, which included only relatives and friends, were at first purely spontaneous with each individual or circle. As the ceremonies became more elaborate and prolonged, the father, eldest son, medicine-man, or chief became director, until with further elaboration into fixed and regular forms of emotional expression, there arose the beginnings of a specialized class of priesthood. When they had obtained full control, there arose the phenomenon, remarkable in that it continues to our own day, of the priesthood's trying to formulate the reasons for the ceremonies and existence of church-days, and these efforts taking on the shape of creeds

and commandments—which, however necessary as expedients, touch the truth only most symbolically.

The hint has already been several times offered that holidays, starting in the psychological way of reflex action, have had their growth according to the law of all growth—evolution, by which they have progressed from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity. A caution must be interposed here, however, before the completion of the law is pointed out. It must not be supposed for an instant that the development took place in such distinct steps as might be inferred from the grouping of our historical references: that domestic festivals were completely or at all generally in custom before tribal or national demonstrations came into vogue; that only after these were current in an occasional way were harvest festivals held; and that not until the moon's cycle had been quartered did the recurring solar periods become associated with regular emotions. On the contrary, each of these logical periods largely overlapped the next, so that nearly or quite all of them have been contemporaneous in various degrees of advancement. We can only hold that, on the whole, the growth of holidays has been according to some coherent method whose outline is found to be the law of evolution.

The completion of the law is that with the increase and specialization of holidays there has been a concomitant loss of emotion, but that the retained emotion has undergone a like process from homogeneity to heterogeneity. This is seen in the fact that though the Africans and Polynesians show that holidays began as overflows of emotion, yet on ascending through the history of the Indians, Asiatics, Americans, and Europeans, festivals have become less demonstrative and more varied and restricted in their meaning. This fact gives us the key to the radical change which has taken place in the character of our modern holidays as compared with those of primitive man. As man became capable of quiet feeling and reflective thought, the various internal and external stimuli were less and less forced into reflex demonstrative action. He could experience joy and sorrow, bravery and hospitality, reverence and worship, with an ever-lessening muscular action. Most of all, perhaps, is the change due to the share of stimulus which went to thought. This is first seen in the difference between occasional and periodic holidays. The periodic days added to the pure spontaneity of occasional days the new intellectual element of association of ideas. Certain feelings came to be associated with certain phases of the moon or seasons of the year, the periodic recurrence of which revived with lessening intensity the emotions and reflex actions of the original event. The calendar festivals came to *mean* more; though they lost in demonstration, they gained in thought: free gladsomeness grew

serious. Thus it came to pass that religion and the Church appropriated so many of Nature's festivals; that the Roman *Saturnalia* became our precious Christmas, the full-moon spring equinoctial feast grew into our beautiful Easter, and the harvest feast took the form of a Thanksgiving service.

These changes suggest the function and future of holidays in the light of their origin. As shown above, the psychical growth of man from an emotional to an intellectual creature has almost entirely changed the function of holidays. The truest survivals of the primitive emotional reflex-action function is seen in the children's April-fool's-day and our modern wedding shows. But the element of association, which was the genesis of our periodic days, is of more lasting power. The intense rush and struggle for existence of the modern world found less time for occasional festivals, and so needed more of the periodical reminders of events which our fathers or our ancestors first celebrated. But we note now an appearance of decadence which seems inevitably to await holidays. The original cause for the day being forgotten, from being a day of amusement, joy, and gayety, set apart in honor of some person or in commemoration of some event, it became a consecrated day, a religious anniversary or national festival, until it acquired the modern distinctive characteristic of a day of exemption from labor. To be sure, a feast always necessitated a change from ordinary occupations, but this was only an incidental condition to the expression of emotion. This function of a "rest-day" came into prominence, as we have noticed, with the Accadians and Babylonians, but it naturally has only become predominant in a pre-eminently industrial age. For the sake, then, of inculcating Mr. Spencer's text, "Work to live, and not live to work," if for nothing else, holidays still have a claim to our support; and we as a people are not so far removed from barbarism but that such wholesome texts and demands, even of nature, come to us more imperatively and efficiently in the guise of custom or in the name of religion. So, though our national holidays are fast losing their original meaning, and though church-days, and particularly Sunday, tend to become secularized, let us hold to them, under whatever form or sanction, for the sake of their modern function.

Are we, then, ultimately to lose holidays? Not to be too confidently prophetic, but judging by the historical tendency, we would answer, "Yes" and "No"—yes, as to the distinctive calendar demonstrative days. With the decadence of the emotional function, however, we found that the function of suggestion of deep feeling and many-sided thought remained and increased. Because our sensations *mean* more to us, because the thousand and one phenomena of our daily life are arranged and related in most delicate articulation, because emotional life will always live

in increasing refinement, and there will ever be need of a language of signs, so the height of specialization can only end in making every day a holiday indeed. Not that every day will be free from labor, or consecrated to a saint, but that the intricate world of things, of feelings, and of thoughts in which we live, will become so full of ever-present meaning to us that their stimuli will find daily rather than occasional expression, with a single or half-dozen friends instead of a multitude, with shorter hours of labor and longer hours of health, with music rather than with fire-crackers, with ever-thoughtful kindness instead of formal ceremony, and finally with pure and noble daily inspiration for living rather than a funeral pageant.

NEW FACTS IN ALCOHOLIC HEREDITY.

By T. D. CROTHERS, M. D.

SOME years ago I examined two inmates of the Deaf and Dumb Asylum, at Hartford, who from birth had distinct symptoms of acute intoxication. Both were boys, aged nine and thirteen years, who walked with a staggering gait and great muscular incoördination. One had a demented grin, and nodded continuously whenever he saw any one looking at him. The other had a dull, vacant stare, and congested, blear-eyed appearance. He was very irritable, and sensitive to observation, trembling with anger from any little cause. These and many other signs of intoxication were present, and had been noted from birth. The parents of both were inebriates. These cases aroused my attention, and since then I have gathered many notes and histories of similar cases.

Greatly to my surprise, I have found that these cases were not uncommon, especially in asylums and hospitals, and also in active life. Many of them are not so marked, and others require some peculiar conditions or circumstances to bring out these symptoms.

The history of the cases I have obtained may be divided into two classes: one, in which the symptoms of intoxication are present all the time; the other, in which these symptoms only appear from some peculiar circumstances or exciting causes.

In the first class, some prominent defect, such as idiocy, imbecility, and congenital deformity, is present, giving the case a distinctness irrespective of the signs of intoxication. Hence, these symptoms of drunkenness are not separate from other defects in observation. Thus, in a prominent family, one of the children, an imbecile, had all the suspicious hesitancy of manner, also the walk, of a drunkard.

In a private school for the feeble-minded from the wealthier classes, three in fourteen cases had these unmistakable symptoms, which had not attracted attention.

In the home of a former patient I found a little girl, an idiot, whose voice and rambling utterance, with intensely red eyes and drunken expression, pointed back to causes and conditions that had not been noticed before. Other defects and deformities of the face and body cover up these peculiar signs of intoxication.

These symptoms may appear after birth, or be slowly evolved with the growth of the child, coming into prominence at or before puberty.

Of course, all the varied phases of idiocy, imbecility, progressive degeneration, and malformation go on. The presence of a special class of symptoms, resembling intoxication so clearly, suggests a distinct alcoholic causation. In the second class I have noted, the alcoholic symptoms are not present, unless from some exciting cause (non-alcoholic), such as anger, fear, sudden excitement, etc. In this class are idiots, imbeciles, and defectives of all degrees, who at times display distinct signs of intoxication, which subside after a period. Often in these cases appear the common delusions and deliriums of intoxication: also, the semi-paralysis and stupor. Teachers and superintendents of asylums and schools for this class realize clearly the danger of excitement on these dements and defectives, throwing them into various states of mania, as well as intoxication. In one instance, an imbecile boy would become agitated and fall into a state of intoxication if sharply watched, or excited by any cause.

In another case, an imbecile from his birth appears intoxicated when he first meets you, but quickly recovers himself, and all these symptoms pass away. The embarrassment of meeting strangers develops these signs of intoxication. The history of such cases uniformly points to inebriate ancestors. The common explanation of these symptoms is, that this pathological state reflects the condition of one or both parents at the time of conception, or some profound antenatal impression. To support this view the history of the parents gives evidence, and also, in some cases, the peculiar form of intoxication in the parent is seen in the children. Thus, in one case the father, when intoxicated, had a delirium of agitation, in which he moved about incessantly; two idiot children born to him both showed signs of intoxication and had muscular agitation and delirium.

In another case, a woman, when intoxicated, manifested hysterical fear of dogs. She had an imbecile child, which almost went into convulsions at the sight of a dog, and had all the symptoms of intoxication. Numerous instances are on record of profound impressions on the mother's mind leaving a similar im-

pression on the offspring. In one instance an exceedingly nervous lady was greatly frightened by an intoxicated soldier. She gave birth to a boy that had all the signs of intoxication. He lived until twelve years of age, was an imbecile, and had all the marks of a person perpetually intoxicated; he staggered, and would scream out from time to time, without cause or reason. Another case is reported where the mother saw her husband stupidly intoxicated for the first time, and gave birth to an imbecile boy, who was stupid and acted as his father did when poisoned with spirits. It is often difficult to trace these peculiar symptoms, which resemble intoxication, to a similar state in one or both parents at the time of conception; but in most cases the probability of such a state is greatly strengthened by general circumstances and various marks of alcoholic defects and deformities. I find myself forced to conclude that these symptoms are inherited as special pathological states, representing the parents at the time of conception. Why they do not occur in all cases is not clear, but the fact is beyond question that children of inebriates bear marks of defective organization of almost infinite degree, form, and variety.

Beyond this range of cases there is another class, less common, yet with a distinct history and symptoms. Unlike the first class, they are persons who have average brain-power, and in many instances are men of genius and positive force, with a peculiar nerve-organization. They are usually temperate men, never using alcohol, yet under certain circumstances, and from some particular excitement, act and appear as if fully intoxicated.

In these cases some form of mental shock takes place, destroying the normal balance and bringing uppermost an inherited neurotic defect. In some instances alcohol can not be tolerated without producing nausea, vomiting, and extreme depression; and yet from some unknown cause, purely mental, they will suddenly exhibit all the usual signs of intoxication, which pass off as quickly as they came on.

These cases come from inebriate parents or moderate drinkers, and have inherited some defective nerve-organization which manifests itself in this way. I have collected a number of these cases and grouped them under two heads—one of inherited toxic states, and the other of acquired toxic states. In the first class the notes and histories I have gathered will serve as an outline for more exhaustive studies, and they also suggest many new fields of psychological heredity not yet explored. The following are histories of some of these cases:

First Case.—Joseph B——, a farmer of fifty-four, temperate, a man of character and wealth, who had never used any kind of spirits, suffered from a violent shock and alarm from a runaway

horse. He was thrown out of the wagon and only slightly bruised, but could not walk after. His face was red, his voice jerking and husky, and his language silly, and he staggered with every appearance of a drunken man. He recovered, but was thought to have used spirits. Some months after, at the funeral of his child, all these and other marked symptoms of intoxication returned, to the great mortification of his friends and family. A year later another similar attack occurred from the burning of some outbuildings on his farm. A careful inquiry made it clear that he had not used any spirits, although he had all the signs except an alcoholic breath. His father was an excessive user of spirits, and his mother died of consumption, but could never tolerate the smell or taste of alcohol. He has been gradually becoming weaker for some years, and is now an imbecile.

SECOND CASE.—The treasurer of a large manufactory, temperate but very nervous, and a hard-working man, of forty-eight, suddenly appeared intoxicated when accused by the president of falsifying the books. He was unable to talk rationally, and both appeared and walked like one who had drunk large quantities of spirits. The next day he recovered, and fully explained, to the satisfaction of all. He was ill for a week, with some general debility and indigestion, then went to his duties, became angry, and had a similar paroxysm. A short time after another attack came on at his house, and the physician called it congestion of the brain. In all these instances no evidence of having taken any spirits could be obtained. His father was a sailor and drank freely.

THIRD CASE.—A merchant, of fifty-eight years, lost all his property in a series of unfortunate speculations. He was much depressed, and went to live with his brother-in-law, a physician. He had been a temperate man from principle, and was in good health up to his failure in business. One day, on the receipt of a letter with bad news concerning some business matters, he became to all appearance intoxicated. His brother-in-law, the physician, made a careful examination of all the facts and surroundings, and concluded that this was a case of what he called mind-intoxication, or drunkenness from causes other than alcohol or drugs. A few weeks later a similar occurrence followed an exciting interview with a creditor. During the two years which preceded his death, three distinct attacks were noted, each one lasting from two to six hours. He died suddenly from pneumonia. His ancestors were both moderate and excessive drinkers.

FOURTH CASE.—A recent one. A merchant, in good health and temperate, while at work in his counting-room, received a dispatch of the death of his daughter. He lay down on a sofa in his office, and very soon became wildly intoxicated. A physician

made this diagnosis, although there was no odor of alcohol in the breath. He was taken home, and remained in bed a week. Two opinions prevailed: one, that he had drunk in his office; the other, that it was congestion of the brain. He denied having used spirits, but was confused about the events of the past. In this case a similar heredity from alcoholic ancestors was present.

These cases are sufficient to illustrate the clinical fact that I am attempting to demonstrate. I am informed by good authority that during the late war many similar cases were noted, and were the subject of much comment and speculation. Thus, men who were total abstainers would, under the excitement of the battle-field, exhibit the wild frenzy of a drunken man or be stupid and largely unconscious of the surroundings. As an illustration, a noted officer at Antietam came riding back from the "front," swaying in his saddle, and shouting parts of songs, in a marked drunken state.

He was a total abstainer, and had not drunk any spirits, but had been at the "front" for hours under great excitement, having a horse shot under him. His conduct was so strange and wild that he was ordered back, under the impression that he was intoxicated. Different surgeons noted this strange frenzied state on many occasions, but in the excitement and change of battle could not ascertain whether it came from the use of spirits or from some mental state. On many occasions it was clear that by no possible ordinary means could spirits be obtained, and yet men previously temperate seemed fully intoxicated. When the battle was over and a degree of relaxation took place, many men would exhibit childish excitement and delirious irritability identical with alcoholic intoxication. At other times, after a period of prolonged strain and excitement, when coffee was given freely, the same inexplicable symptoms of intoxication would appear and be termed "coffee-drunk." When these symptoms appeared at the "front" under fire, they were termed "*battle-drunks*." Some facts very similar have been noticed in the navy, in the case of gunners, who after a short time of exciting work would become like drunken men and be obliged to go to their berths. This condition has been noticed in persons who were shocked or greatly alarmed at the time of great disasters. A railroad superintendent informed me that on two occasions he had noticed instances of the apparent intoxication of railroad-men who seemed to be at fault through an accident. The intoxication came on after the accident; but from a most careful inquiry he was convinced that they had not used any spirits then or ever, and that their condition was unaccountable.

An incident was related to me by a gentleman, who had been talking quietly in the cars with another man, when they were

thrown down a steep embankment. The car-side was broken in, and both were thrown out, only a little bruised. In a few moments one was fully intoxicated. The other, the narrator, could not understand this state or explain it in any way. From these and other statements which I have gathered I conclude that these cases are not infrequent, but, from want of accurate observation and the difficulty of obtaining the facts, they are overlooked. As far as it could be determined, I think that every case had a prominent substratum of direct heredity from inebriate ancestors. In the partial history of some of these cases some form of brain-exhaustion was present, and the shock or paralysis brought to light the special pathological symptoms of alcoholic poisoning. It would be foolish to deny that this was a special nerve and brain defect transmitted from the parents, and only came to light from the action of some particular cause.

In the case of a total abstainer, who, during some state of excitement, manifested all the symptoms of intoxication, where beyond doubt he had not used any form of alcohol, and where inebriety existed in the ancestors, it would be a most reasonable conclusion to infer an origin in heredity, which burst into activity in obedience to some unknown exciting cause. From this point many and varied questions start up, which future observations and studies alone can determine. I think these cases are of the same class as idiots and imbeciles, with special symptoms of alcoholic poisoning, as a direct heredity from the parents; any difference being simply in the fact that these special pathological defects are dormant, but only appear from the action of some peculiar cause. This seemingly represents the conditions of the parents at the time of conception or some antenatal impression. The second class of acquired toxic states have less of mystery, and are more common. They are of the class of men who have been inebriates or intoxicated, and have become total abstainers, but from the same unknown causes suddenly manifest all the old signs of intoxication. Some factor of heredity is present, and possibly some nerve-tracts, along which abnormal energy has been very active in the past, may come into prominence again. An outline of some cases will bring out these facts:

FIRST CASE.—The superintendent of a factory, a man who had been temperate and sober for fifteen years, his conduct and character beyond all reproach, was engaged to be married, under circumstances of great promise. The day of the wedding the bride received a letter, warning her against him, saying that he was a secret drinker and a bad man otherwise. This she sent to him by the hand of her brother. After reading it, he showed all the signs of intoxication, and went to bed. The wedding was postponed, and he afterward asserted so positively his innocence that

I was called to give an opinion. An examination indicated that this was some condition of shock, or sudden congestion, in which symptoms of intoxication appeared; also his assertion of not having drunk was literally true. A history of moderate and excessive drinking was noted in his parents.

SECOND CASE.—A clergyman, with a marked history of heredity. He was under my care for five months, when, one day, a brother clergyman paid him a visit, and no doubt talked very severely to him of the sin of drinking. I found him a short time after, in bed, with all the symptoms of intoxication. He had a childish, idiotic expression, and was in a semi-delirious state. He remained in bed two days, and had all the appearance of one who had suffered from alcoholic poisoning. This was the first pronounced case I had seen, and could not be mistaken. The sudden emotional excitement precipitated him into the pathological state of intoxication.

THIRD CASE.—This case was sent to me for an opinion as follows:

A noted temperance lecturer, formerly an inebriate, for ten years or more had been an abstainer. One evening, while lecturing, he was given a dispatch from his wife, announcing the fatal illness of a child. He drank a glass of water, and attempted an explanation to the audience, became confused, staggered, and acted like a man rapidly becoming intoxicated. He was finally led from the stage, and laughed and shouted in a maudlin way. The audience supposed that he was drunk, but all the circumstances showed clearly that no spirits had been taken.

These cases are most strikingly confirmed in many ways, and especially in circles of temperance reformers. One man of my acquaintance, after an eloquent lecture of an hour, during which he most dramatically portrays the conduct and manner of an inebriate, will go to his room and be practically intoxicated for some time, or until he can procure a few hours' sleep. This man has been an inebriate, but for the past five years has been lecturing on inebriety with great power and skill. He has been in the Prohibition campaign, and lectured for months incessantly. These phases of drunkenness are called "queer spells" by his friends, and are guarded from observation. When the lecture is over, he retires at once to his room, and will not be seen until next morning. In another case a man of talent and genius of a high order, who had drunk to great excess for ten years, stopped and became a lecturer. He told me that often the impulse to drink was so strong that he could only resist it by having an audience and opportunity to talk or plead for temperance. He was really intoxicated in his extravagant enthusiasm and dramatic portrayals of the evils of drink. After the lecture was over, he was greatly

exhausted and had all the feelings of one who had just suffered from intoxication. The psychological student will find a rare field of study in the temperance meetings of the day, particularly where they are conducted and addressed by reformed inebriates.

These facts are along the line of every day's observation, and are sustained by many collateral evidences. Beyond this are still further ranges of facts, on the same psychological field, less common and more obscure.

A pathological state has been observed, which I call unconscious imitative inebriety, where persons, from the influence or contagion of the surroundings or some unknown factor, are, to all intents and purposes, intoxicated. Here, as elsewhere, a strong substratum of heredity exists. I present the notes of two cases which were sent me by accurate and very competent observers. One, J. H——, was a lawyer, a delicate, nervous man, employed in the State Department, where a monotonous, exact range of duties had been performed for many years. He was unable to use spirits, from the headache it produced. Although his father was an inebriate, he never could or would drink any form of alcohol. He was a society man, and spent his evenings at the club. For several years past it was noticed that, after an hour or more spent in company of men who were drinking to intoxication, he would take on their condition, and like them become intoxicated. He would be with them hilarious or stupid, and use only coffee moderately, while the others drank wine. Sometimes these states would go so far as to make him stupid and unable to walk, and he would need the assistance of a guide and carriage to get home. The next morning he would have a headache. These occasions were at first infrequent, then grew more common, until at present he can not remain an hour in the company of any friend who is intoxicated without appearing and acting like him. He is called by his friends the "coffee-drunkard," for this reason. He will be as stupid as any of them, and yet use nothing but coffee. He would fall into this state more slowly if strangers were present, and sometimes not at all, depending on some internal force that prevented him from giving way. He affirmed that the sensation was very pleasant, and he did not realize his own condition, but was always conscious of enjoyment, until the party broke up and he went home, when a feeling of misery and disgust came over him. The physician who examined him in these states considered that he was a perfect barometer of the mental surroundings, and that after a certain point he gave himself up to a species of mesmeric influence, making him do anything that the others did.

SECOND CASE.—A wealthy farmer and strong temperance man was elected to Congress. He formed a strong attachment for a

hard-drinking man in the same body, and, after being in his company for a few hours, would walk and talk like him. He would talk foolishly, and stagger, and act identically like him; but if called away, he soon recovered and was as before, yet in his company he used no spirits, and only occasionally soda. This imitation intoxication grew on him, and he seemed to fall into this state in any drinking party where several were intoxicated. He was not aware of his hilarity or stupidity in drinking company, and only remembered that he could not use spirits. He was reported to be intoxicated in the papers, and could with great difficulty make any defense. He is still in office, but has learned to keep away from all drinking men and state dinners where wine and intoxicated and hilarious drinkers are present. A hereditary taint of both insanity and inebriety was present in his case. I have made another group of these cases, that brings out some facts seen in other circles of life. They are cases of reformed men who show signs of intoxication from the contagion of others who are intoxicants. The following is an example:

A prominent military man, who had drunk moderately during the war, and had abstained from that time on, while attending a dinner with his old comrades, where most of them were intoxicated, suddenly became hilarious, made a foolish speech, and settled back in his chair in a drunken state, and was finally taken home quite stupid. He had not drunk any spirits, and had only used coffee and water, and yet he had all the symptoms of the others, only his was intoxication from contagion—the favoring soil had been prepared long ago in the army. Another case was that of a man who had been an inebriate years ago, but had reformed. He was recently elected to office and gave a dinner to some friends. Among them was a physician, who has been greatly interested in these studies. He sent me a long report, the substance of which was this: On the occasion referred to, many of the company became partially intoxicated, and the host, who drank nothing but water, became hilarious, and finally stupid with them. He was put to bed, with every sign of intoxication, but recovered, and next morning had only a confused notion of these events. The third case occurred four years ago. A reformed man, of twelve years' sobriety, went on a military excursion with a drinking company, and, although he drank nothing but lemonade, became as much intoxicated as the others. This event was the subject of much comment and loss to him, socially and otherwise, although he protested, and others confirmed his statements, that he did not take any spirits at this time.

In these cases, as in the others mentioned, two conditions were present: one, in which some special unknown nerve state was inherited, which readily reflected alcoholic states from contagions;

the other, in which this particular alcoholic state had been acquired, and more readily responded to contagious surroundings than otherwise. In both cases, undoubtedly, heredity was present, but in the latter some previous pathological state existed. What form of brain and nerve defect, and what circumstances and conditions combined to develop this special pathological state must be determined in the future. Along this line are many psychological facts of great interest, that throw light on other mental states. Thus, actors, who essay to represent insanity or inebriety, are successful in proportion as they inherit a nervous organization predisposing them to these affections. A single glass of spirits may awaken a latent nerve defect, and soon after merge into inebriety. So the effort to imitate the manner and conduct of an intoxicated person may give impress and direction to an organism that may be permanent.

An actor, greatly praised for his skill in "Hamlet," was obliged to leave the stage, for the reason that this character was becoming so intimately his as to suggest insanity at an early day. A man who acted the part of a drunken man was, after a time, so completely intoxicated as to be unfit for his part. He could not use spirits, and had to give up this part of the play, for the same reason as mentioned above. A remarkable incident came to my notice along this line. A temperance writer, of great power and vividness of detail, said that he lived all the details of the hero he was describing, in his own mind. When the character was intoxicated, he had all the symptoms, and had to go to bed after writing that the hero did so. He suffered, was exhausted, had pain, mental agony, was joyous, happy, contented, and lived over every event which he described. This man was strictly temperate, but had a drunken father, from whom he inherited a peculiar nervous organization, that gave him power to realize the toxic state from alcohol and throw himself into it more perfectly.

He says that it would impair his health to write more on this theme, for he would be intoxicated most of the time while writing. Many of these states may be termed emotional trance states, and in some future time will be the subject of some very curious and wonderful psychological discoveries. Those who observe inebriates carefully, find them literally encyclopædias of psychological fact, that can not be understood by any present knowledge of the subject. For instance, reformed men, or those who have recently stopped the use of spirits, can not safely listen to a recital of the sufferings and struggles of others to become temperate, without taking on some form of mental shock that is fatal to their own resolutions. The more vivid and accurate the struggles of a drunkard are described, the more certainly the will of the hearer is weakened and rendered impotent to help itself. Temperance

lecturers, who hope, by painting the horrors of drink so vividly, to deter any one in the audience from falling in that way, are deceived, and produce the very effect they seek to remedy.

In the same way, the sight of an intoxicated man produces a dangerous form of excitement in the mind of the reformer, and if this should last some time it would react in the same condition. I have embodied many of these curious facts in a paper, with the title of "Mental Contagion in Inebriety," published in the "Alienist and Neurologist" of October, 1884. In this brief glance of the subject I have endeavored to bring out the fact that states of intoxication are found in inebriates and defectives that are marked inheritances from parents. The organism has received a positive permanent impression, from which it never recovers. Also, that this pathological state of acute poisoning from alcohol may be covered up by other defects, and only come out from the application of some peculiar exciting cause. I have called attention to a class of cases, that, from some exciting cause, suddenly become to all appearance intoxicated, although they have not used spirits. An inherited predisposition to this form of defect, from inebriate ancestors, is present in these cases. Also a class of men who have been total abstainers for a long time, who, under similar conditions of excitement, appear intoxicated.

I have described a class of cases where the intoxication was purely from mental contagion, appearing in persons who have been previously drunk, but were temperate at this time. Undoubtedly, conditions of heredity, unknown at present, control and govern this condition. It will be clear from this outline-grouping of facts: (1) that symptoms of alcoholic poisoning can not be trusted as evidence of the immediate use of alcohol; (2) that *the excessive use of alcohol* leaves a permanent defect or impress on the brain, which will go down into the future with great certainty. It may be concealed for a lifetime in the child of a drinking parent, but at any moment may come to the surface, from the application of its special exciting cause; or it may appear in some other form of defect that can be traced back to the injury from the toxic action of alcohol. In brief, the range of facts that open up from this point are truly bewildering, and their discovery and the laws which govern them is the great future realm for investigation.

This grouping of general facts which I have presented, like a preliminary survey in a new country, are merely landmarks for other and more accurate studies.

This is the field into which specialists press forward with increasing enthusiasm, confident that behind all this mystery of drink-craving will be found a majestic order of forces coming

from unknown causes, moving in unknown orbits and about unknown centers; also, with equal confidence, that, not far away, inebriety and its evils will be understood, treated, and prevented, as positively as any other disease.

COMMENTS ON THE "SACRIFICE OF EDUCATION."

PROF. F. MAX MÜLLER.

CONSIDERING that nearly forty years ago I did my best to prove the necessity of examinations for admission to the civil service, it will be believed that I did not sign the foregoing protest with a light heart. Before the Indian civil service had been thrown open, and before Sir Charles Trevelyan had carried his reform of the civil service in England, I was allowed by the then editor of the "Times" to publish several letters signed "La Carrière Ouverte," in which I said all that could be said against appointments by patronage and in favor of examinations.

Nor should I wish to withdraw now any of the arguments which I then advanced. I hold as strongly as ever that appointment by patronage is too much for human nature. But I believe the time has come to examine the examinations, to improve them, and to reduce, if possible, the evil which, in addition to much real good, they have produced. The present system of perpetual examination, in spite of all the good which it has done, stands self-condemned, so far as our public schools and universities are concerned, by two facts which can not be contested; viz., (1) the number of men who, after having spent six years at a public school, fail to pass the matriculation examination in college, or the little-go examination in the university; (2) the number of men who, after having taken a degree at Oxford or Cambridge, can not pass the civil-service examinations without spending a year or two with a crammer. These facts speak for themselves. I wish, indeed, that I had time to go fully into the subject, but I have not at present, and I must be satisfied with giving my general impressions, and saying what is uppermost in my mind.

From what I have seen at Oxford and elsewhere, all real joy in study seems to me to have been destroyed by the examinations as now conducted. Young men imagine that all their work has but one object—to enable them to pass the examinations. Every book they have to read, even to the number of pages, is prescribed. No choice is allowed; no time is left to look either right or left. What is the result? The required number of pages is got up under compulsion, therefore grudgingly, and after the examination is over what has been got up is got rid of

again like a heavy and useless burden. Nothing is converted *in succum et sanguinem.* The only thing that seems to remain is an intellectual *nausea*—a dislike of the food swallowed under compulsion.

The mischief done is, I believe, most serious. It will poison the best blood of England, if it has not done so already.

It is the best men who suffer most from the system of perpetual examination. The lazy majority has, I believe, been benefited by it, but the vigor of the really clever and ambitious boys has been systematically deadened. Formerly some of my clever young friends were what is called idle at Oxford, but during their hours of idleness, which mostly meant discursive reading and thinking, they grew into something, they became different from others. Now, my young friends seem all alike, all equally excellent, but so excellent that you can hardly tell one from the other. What is the result?

We have excellent members of Parliament, excellent judges, excellent bishops, excellent generals: but if we want to know Who is Who! we must often consult a Red-Book. England is losing its intellectual athletes who were a head and shoulders taller than the rest, and used to be looked up to as born leaders of men. And if history teaches anything, it teaches us that no country remains great without really great men, without a few men different from the rest.

I am asked what remedy there is. In the university there is, I believe, a remedy. Let there be two sets of examinations, one for clever and studious men who promise to take high honors, another for the many. For the latter the examinations might remain what they are now. Only the degrees might be given, not in the name of the university, but in the name of the different colleges. For the former there should be a real matriculation examination held by the university, not, as now, by the colleges; and then, after three or four years, a final examination might follow for real academic honors, allowing great latitude in the subjects of examination.

Much depends in all this on the examiners. In England most examiners are young men, in Germany they are invariably old. The *professores ordinarii,* who alone examine for academic degrees in German universities, try to find out what candidates have learned and know; our young examiners seem chiefly bent on finding out what candidates do not know. Add to this that in some cases, though rarely, examiners are actually the same persons who have crammed their examinees, and it may be imagined how human nature is tried in that process, and what the result must be.

With regard to the civil service, I know no substitute for

competitive examinations. Competitive examinations, however, might be toned down to a minimum, and a year of probation might possibly be substituted for the final and decisive examination. I say possibly, for, as is well known, we have always to think of "Take care of Dowb."

Two things seem to me necessary: (1) A careful supervision of examiners. If the examinations are to remain in the hands of the youngest members of the university, their report should always be made, first of all, to the respective faculties, and afterward only, when approved by the faculty, to the vice-chancellor. The necessity of this has been shown by recent experiences in India and elsewhere. (2) A gradual change of competitive into qualifying examinations.

Many years ago we wanted to have examinations for the sake of schools and universities; we now seem to have schools and universities simply and solely for the sake of examinations.

PROF. EDWARD A. FREEMAN.

OF the working of the fashionable fancy for endless examinations, I can speak from direct knowledge only in my own university. Coming back to Oxford, after many years of non-residence, I was perhaps better able to compare what is and what was than either those who have never known anything but the present system or those who have seen the present system grow up. Just now it seems to be understood that examinations are the chief end of life, at any rate of university life; they would seem to be thought to have an *opus operatum* merit for both the examiner and the examined. The object seems to be to multiply examinations as much as possible, to split them up—what is called to "specialize" them—to the extreme point. A man is not, as of old, wholly plucked or wholly passed; with the ingenuity of Italian tyrants, a piece of him is plucked or passed, while the rest of him is kept for the sport of another day. The end steadily kept in view would seem to be that examinations should never cease, that therefore nothing should really be learned, that examinations should follow so fast on one another as just to give time to forget the matter of one examination before the next comes on. The thing has grown to such a height that names can not be found for some of the endless schools, they have to be marked by numbers and letters. The gravest personages will be seen debating with the gravest countenances over some peddling change in "Group A 1," seemingly without the faintest feeling of the grotesque nature of their employment, or of the *reductio ad absurdum* of the whole system which is implied in such a nomenclature, if nomenclature it can be called. The Oxford undergraduate is even examined before he comes into being; the exercise

called responsions, the exercise for the now perhaps forgotten *status* of *Generalis Sophista*, is now grotesquely performed on lads not yet members of the university. In natural science, above all, examinations and examiners multiply daily. The luxury, to be sure, is a costly one; it sometimes costs fifty or sixty pounds to examine a single man; but the thing must be done, under pain of loss of character. For in the matter of what is now called "science"—a word which used to have another meaning—the many are in the hands of the few. A proposal for a new examination in any other branch is canvassed, perhaps thrown out, because men have some notion what it means. But "science" is shrouded in mystery. A new -ology is invented; not a dozen persons in the university know what the ology is about; but no one dares to oppose a fresh examination in it, for fear of being called retrograde, obscurantist, opponent of the march of intellect, any other anathema with which the Holy Office of "science" may be ready. And so the thing goes on merrily; everybody is examining or being examined, save during the short intervals allowed for forgetfulness between one examination and another.

Now what has come of all this? Simply the degradation of university learning and teaching into a trade. Each undergraduate seems to do a sum to find out what form of examination may be most profitable to choose—profitable, that is, not to the understanding but to the pocket. I was not a little surprised when, after my return to Oxford, I heard the words "the pecuniary value of a first class." Such words were assuredly never heard in my younger days. A man was rejoiced to get as high a class as he could, both because of the credit of the thing itself and as an augury of a coming fellowship; but he never reckoned the exact value of the class in pounds, shillings, and pence. Another phrase that startled me was that of the "tutorial profession." A college fellow who in my day undertook, most likely for a few years only, the further duties of a college tutor, certainly never thought that he was entering a special "profession." But, owing partly to the growth of examinations, partly to the new position of college fellows which has followed on the fatal permission of marriage, the "tutor," if he can so be called, is now altogether another kind of person. He reaches his fullest modern development in the "combined lecturer," of whom, as he is powerful, one must speak delicately. To him, teaching is strictly a calling; it is a calling and not an office, for he is ready to practice it wherever he can find employment, and he is, moreover, a mere teacher, not discharging any of the other duties of the old college tutor. Without being a university professor or reader, he teaches men from various colleges, but he does nothing except teach them. And he is strongly tempted to teach them a great deal too much,

and in the wrong way. When examination after examination becomes the main object, there is sure to be a great deal too much teaching, so much as to leave no time for learning on the part of either teacher or taught. The legitimate duty of a university teacher is to guide his pupil to the right books, the great books of the subject in hand, and to act as a commentator on them. But this implies that the object is, not the passing of an examination, but the study of a subject. When the teacher's business is understood to be to "get a man through" an examination—whether the result of that examination is to be a mere pass or a first class with its "pecuniary value"—study of the subject, study of the great books on the subject, passes away. The teacher puts himself in stead of the books; the thing becomes, in plain words, cram.

This is the *tendency* of the modern fancy for endless examinations. Of course it does not prevail equally in all subjects or with all teachers. It can not prevail so fully with the older subjects, where something of the better tradition of the past is still kept up, as it does with subjects of later introduction. Every man sees his own grievances more clearly than those of his neighbor, and to me it seems that what is called "modern" history is the worst off of all. It is at least worse off than "ancient" history, from which it is so senselessly parted in a separate school, to the great damage of both. For about "ancient" history there still clings something of the traditions of better times, times when men read great books with a tutor instead of filling their note-books with the tips of a crammer. I once asked a man who came to my lectures, "Have you a book?" meaning, in my ignorance, a copy of the author whom we were going to read. He answered, "I have a note-book." That seems to be the net result of forty years' tinkering of everything, of multiplied examinations and multiplied teaching, to drive away "books" and to bring in "note-books." And the professor can do nothing; he can only work away in a corner with a few who are still ready to toil at the text of books, while the combined lecturer flourishes amid a whole library of open note-books. For the professor is useful only to those who seek for knowledge; the combined lecturer, it is fully believed, can guarantee "the pecuniary value of a first class."

Every examination is in itself an evil, as making men read, not for the attainment of knowledge, but for the object of passing the examination, perhaps of compassing its "pecuniary value." But it may be hoping too much to hope that examinations can ever be got rid of altogether. If they must be, then, instead of being many and piecemeal, they should be few and searching. Instead of giving a man time to forget his various subjects one by one, they should make it needful for him to remember his work as a whole. In Oxford we ought to have (1) a matriculation examina-

tion; (2) an examination for B. A. much on the lines of the old one before tinkering began about 1849; (3) an examination (or other exercise) for the degree of M. A. of as varied a kind, and, at the same time, of as "specialized" a kind in each case as anybody can want. The complete degree should be given only to those who show real proficiency in some subject, the last "-ology" counting as one. Thus only can real learning, as distinguished from cram, at least cease to be penal. Whether it will ever reach to a "pecuniary value," I do not presume to guess.

May I end with my own personal experience in a time now far distant? I have deeply to thank my Oxford undergraduate course for causing me carefully to read several books, Aristotle's "Ethics" at their head, which I otherwise might not have read at all or might have read less thoroughly. But I do not thank it at all for examining me in anything. I do not mean because I got only a second class; for I got the "pecuniary value" of a first class in the shape of a fellowship. What I do mean is that I read with very little comfort or pleasure, while there was before me the specter of an examination, deadening everything and giving a wrong motive for one's work. When I had got my degree and my fellowship, I said, "Now I will begin really to read." I began in October, 1845, and I have never stopped yet.

MR. FREDERIC HARRISON.

MY point in this discussion is: That, having been called in to aid education, examination has grown and hardened into the master of education. Education is becoming the slave of its own creature and servant. I do not deny that examination has its uses: I do not say that we can do without it. I say that it is a good servant, but a bad master; and, like good servants turned bad masters, it is now bullying, spoiling, and humiliating education.

Those who teach are the proper judges of what should be taught, how it should be taught, and what are the results of teaching. One of the methods by which they have sought to test the results of their own teaching was by examination—one of the methods, an instrument to be used with discretion, moderation, and freedom. This expedient (a mere subordinate expedient) has silently grown into a system; it has perpetually enlarged its own jurisdiction; it has stiffened into a special profession; it has created a body of specialists called examiners. As a body, the class of special examiners are younger men, of less experience, and, except in elementary schools, of inferior learning, as compared with teachers, as a class. They very soon evolve an artificial and professional skill, and set up hard, narrow, technical tests. Their business is not to teach; but to test whether the

teachers are teaching, and what the learners are learning. This forces the learners not to attend to their own teachers, but to find some way of satisfying the examiners. Examination papers, not text-books, come to be the real subjects of study; the aim of the student is to get an insight into the mind of his examiner, not that of his teacher; and to master, not the subject of his study, but that artificial skill of passing examinations. Thereupon grew up another class of specialists—the crammers. Their business is, not to teach, nor to test teaching; but to enable students to pass the tests. This soon became an art of its own, as artificial as playing whist or the violin. So, in the cricket-field, having called in professional bowlers to practice, it became necessary to call in professional "coaches" to teach the defense of the wicket. And in the result, education is tending to become a highly exciting match, not so much between the players as between the "bowlers" and the "coaches." The teachers are slowly thrust out and controlled by the examiners; they in turn are checked and dodged at every turn by the crammers: so that learning is fast passing into the grasp of two classes of specialists, neither of whom are teachers, nor pretend to teach.

I have myself had experience both of teaching and of examining for more than thirty years, in more than one university, and in several places of learning. Though not belonging to the special class of examiners, I have constantly been occupied with examining, have worked much with examiners, and have had no small experience of the practical working of the system. I need hardly say that I regard the special examiners as a most acute, energetic, and conscientious body of men; and I say the same of the crammers as a class. Both do their work with great ability and conspicuous honesty. It is not the men, it is the vicious system which is in fault. Every teacher knows by experience that, when he has to take his place in the examination curriculum, he has to submit to the system, and he does his best to practice the examining "art." And when, as every teacher nowadays must, he has to turn crammer, he tries to acquire the crammer's art—*omnes eodem cogimur*. Teachers, examiners, crammers, and students, all have to take their place in the vast examining machine, which, like the Prussian military system, grinds out a uniform pattern. The huge examining mill grinds continually, and grinds very fast—unlike the mills of the gods—but the grain it casts aside; it is designed to grind out the husk.

I do not say that we can do without examinations: nor do I object to all examinations, under any condition. My complaint is confined to the incessant frequency of examinations, the growth of the practice into a highly artificial system, the creation of a profession of examining, and its correlative the profession of

cramming, the wholesale, mechanical, and hurried way in which the examinations are held, and the subjection of teaching to examining. In sum, I complain that the trick, the easily acquired and cheaply purchasable trick, of answering printed questions should now so largely take the place of solid knowledge and be officially held out as the end of study.

I shall say nothing about elementary schools. As these are compulsory by law, supported by rates and taxes, and administered by the state and public bodies, and, above all, teach mainly the mere rudiments, there may be reasons for an organized system of examination which do not apply to the higher education. Here the examiners are clearly superior in learning to the teachers; the curriculum itself is more or less mechanical and capable of mechanical tests; and a certain uniformity may be inevitable, and a certain standard of efficiency must be tested. I do not approve of our present system of examining in elementary schools. But I desire to say nothing about it. Nor shall I say anything about the physical effects of overpressure by examination. It is not my subject, and I leave it to others, merely adding, as is plain, that at least nine tenths of any overpressure on students arises from examinations and not from simple study. Nor shall I say anything about official appointments. I have no special theory or plan to support. As a rule, I think people whom we trust to govern must be trusted to select capable agents. If we can not trust them to do this, let us not trust them to govern us. If examinations are required to restrain jobbery, I prefer to deal with the jobbery face to face and by direct means, and not to pervert all public and private education in order to checkmate the wicked jobbers and reward the best crammed ones. Nor am I called upon here to devise a counter-project and to suggest other tests than examination for distinctions and prizes. The distinction and prize system is already absurdly overdone; and nineteen twentieths of the *tests* are wholly needless, or rather actively mischievous. We want neither distinctions, prizes, nor tests in anything like the profusion in which they are now poured out. Art, learning, politics, and amusement are deluged with shows, races, competitions, and prizes. Life is becoming one long scramble of prize-winning and pot-hunting. And examination, stereotyped into a trade, is having the same effect on education that the betting system has on every healthy sport. I do not deny that teachers may usefully examine their own students as a help to their own teaching. I do not say that there may not be one public and formal examination in any prolonged educational curriculum. My plea is against that organized, mechanical, incessant, professional examination, by which education is being distorted, and the spirit of healthy learning is being poisoned.

Examination, like so many other things, is useful as long as it is spontaneous, occasional, and simple. Its mischief begins when it grows to be organized into a trade, and the be-all and end-all of its own sphere. The less the student be "prepared," in the technical sense, the better. The more free the examiner be to use his own discretion with each examinee, the more likely he is to judge him fairly. It was so once. All this is now changed in the thirty or forty years since the examining mania set in. The myriad examinations which now encompass human life have called out an army of trained examiners who have reduced the business to a complicated art as difficult and special as chess. Like chess-playing, the art of examiner and examinee has been wondrously developed by practice. The trained examinee has now learned to play ten examination games blindfold. He can do with ease what the most learned man of the old school could not do. Gibbon would be plucked in the modern history school. Arthur Wellesley would never get into the army. And Burke would have got low marks, through not apportioning his time to the various questions in the paper. I seriously doubt if many of our great scholars, our famous lawyers, historians, and men of science could "floor" off-hand a high-class examination paper. They would not put their knowledge in the sharp, smart, orderly, cocksure style which so much delights the examiner. They would muddle the relation of the *shire-moot* to the *hundred-moot*, or they would forget the point in Smith *vs.* Jones, or they might differ from the examining board as to the exact number of the *isomeric amyl alcohols* now known. All this your trained examinee, well nursed by thorough crammers, has at the tips of his fingers. He "floors" his paper with instinctive knack—seeing at a glance how many minutes he can give to this or that question, which question will "pay" best—and trots out his surface information and his ten-day memory in neat little pellets beautifully docketed off with 1, 2, 3, (α) (β) (γ), the "five elements" of this, the "seven periods" of this movement, and the wonderful discovery (last month) of a new reading by Prof. Wunderbar.

Of course, all this does not take in the examiner. He knows that the student does not know all this, that this is not the wealth of the student's reading, or the product of the student's native genius. But what can he do? His task is to set questions, and the student's task is to answer them. If the questions on paper are answered right, *cadit quæstio*. The examiner's business is not with what the student knows, but with how many questions he can answer, and how many marks he can score. The examiner may see that he is not examining the students so much as the teachers, or perhaps the crammers. All that he can positively say is, that the candidate has been brought to the post perfectly "fit."

The student may be writing down mere "tips" from memory; but if he makes no slip, and he has been carefully crammed, the examiner has to admit that he has got his marks. The examiner may doubt if the knowledge is real, or is worth anything. He can not state that the man has failed. If he had time and opportunity, he could easily ascertain. But in many examinations there is no *viva voce* allowed; in most examinations the public *viva voce* is not thought decisive, owing to nervousness, temper, accident, and various points of temperament and manner. Few examiners now care to decide by *viva voce;* which in any case is done in a hurry and under disturbing conditions that destroy its value as a real test. An examiner has rarely the chance of trying a candidate with a fresh paper, or of giving him as many quiet verbal questions from time to time as he might like. There is no time, there is no opportunity. There are the rigid rules; the candidate is not accessible at the time wanted; he can not be got into a state perfectly composed, easy, and master of himself. A quiet afternoon or a morning's walk would settle it all. But the clock goes round; the machine grinds on; the list must be out in a few hours; the examiners can not sit disputing forever; an average must be struck, time is called, and down goes the candidate's name—usually, be it said, "with the benefit of the doubt."

This is no fault of the examiner. His task is very difficult, trying, and irksome. None but trained men can perform it; and it is wonderful how much trained men can do, and with what patience and conscience they make up their lists. But the higher examiner now has to mark on an average, in a week, from 2,000 to 3,000 answers, perhaps from 4,000 to 5,000 pages of manuscript. In this mass he has to weigh and assess each answer, and to keep each candidate clear in his mind, throughout eight or ten sets of papers. He is lucky if he can do this with less than ten hours per day of work at high pressure—reading in each hour, say, from fifty to a hundred pages of manuscript. He can no more waste an hour, or follow up a thought, than the captain of an Atlantic liner can linger in his ocean-race. The huge engine revolves incessantly; the examiner's mark-sheet slowly fills up hour by hour till it looks like a banker's ledger; some fifty or a hundred candidates get into groups, of Jones, Smith, Brown, etc., or else Nos. 7695, 7696, 7697, etc., and soon Jones, Smith, Brown are labeled for life.

What a farce to call this examination! Any sensible man who wanted to engage a confidential secretary, or a literary assistant, or a man to send on some responsible mission, would not trust to a mark-sheet so mechanical, so hurried. He would see each candidate once or twice alone for an hour or two, talk quietly to him, get him to talk quietly, leave him to write a short piece, set

him to do a piece of actual work, try him backward and forward in spontaneous, unexpected ways, as the quality of each candidate seemed to suggest. He would not burden himself with more than four or five candidates at a time. At the end of a week, a sensible man could perfectly make up his mind which of the four or five was the best fitted for the particular work required, and he would almost certainly be right. Nothing of this is possible in the official examination. The "rules" are stricter than those of a prison. There is absolutely no "discretion." Discretion might let in the demon of Favoritism. The candidates are often numbered and ticketed like prisoners, to avoid the disclosure even of names. The precise number of papers is prescribed, and their preposterous multiplication leaves the examiner about one minute for each page of manuscript. With one or two hundred candidates to get through in a week or ten days, the examination is really like the inspection of a regiment. The uniform and accoutrements must conform to the regulation standard.

It is supposed that examiners are masters of the situation and have a large range for a "free hand." It is not so. The examiner's mind runs into grooves, and a highly skilled class have sorted and surveyed the possible field. In each subject or book there are only available, in practice, some few hundreds of possible "questions." The system of publishing examination papers, and close study of the questions over many years, have taught a body of experts to reduce, classify, and tabulate these. So many become stock questions, so many others are excluded as having been set last year, etc.; and in the result a skilled examinee, and still more a skilled crammer, can pick out topics enough to make certain of passing with credit. Knowledge as such, and knowledge to answer papers, are quite different things. Student and examinee read books on quite different plans, if they wish to gain knowledge, or if they are thinking of the examination. The memory is entirely different. The examinee's memory is a ten-day memory, very sharp, clear, methodical for the moment, like the memory cultivated by a busy lawyer, full of dates, of three different courses, of four distinct causes, of five divisions of that, and six phases of the other. It is a memory deliberately trained to carry a quantity of things with sharp edges, in convenient order, for a very short period of time. The feats which the examinee can perform are like the feats of a conjurer with bottles and knives. The examinee himself can not tell how he does it. He acquires a diabolical knack of spotting "questions" in the books he reads. He gains a marvelous *flair* for what will catch the examiner's attention. As he studies subject after subject his eye glances like a vulture on the "points." Examination is a system of "points." What has no "points" can not be examined.

Many able and industrious students do take the trouble to acquire this *flair;* some will not, or can not, acquire it. But certainly a good many acquire it, by an outlay of labor or money, who are neither able nor industrious at all.

A man going through the full school, college, and professional career now passes from ten to twenty of these examinations, at intervals perhaps of six months or a year. From the age of ten till twenty-five he is forever in presence of the mighty mill. The mill is to him money, success, honor, and bread and butter for life. Distinctions and prizes mean money and honor. Success in examinations means distinctions and prizes. And whatever does not mean success in examinations is not education. Parents, governments, schools, colleges, universities, and departments combine to stimulate the competitive examination and the mark-system. None quite like it; but all keep up the tarantula dance—"needs must when the devil drives." The result is that the Frankenstein monster of Examination is becoming the master of education. Students and parents dare not waste time in study which does not directly help toward success in the test. One hears of the ordinary lad at school or college, either as amusing himself because "he is not going in this year," or else as "working up very hard for his examination." He is never simply studying, never acquiring knowledge. He is losing all idea of study, except as "preparation" for examination. He can not burden his memory with what will not "pay." And a subject which carries no "marks," or very few "marks," is almost tabooed. Books are going out of fashion; it is only analyses, summaries, and tables which are studied. But published examination papers are the real Bible of the student of to-day—*nocturna versanda manu, versanda diurna.*

Next to old examination papers, the manuscript "tips" of some famous coach form the grand text-books. One of the ablest men I ever examined, who bitterly complained that he had failed in a coveted distinction, was told that he had not read his books on a given subject. "Why!" he said, indignantly, "he had not read the text-books; but he had mastered a valuable volume of 'tips' in manuscript, which was said to contain every question which could be set in a paper." He failed through pushing the system too far; and a tragedy was the end.

The examination, thus made the "fountain of honor," governs the whole course of study. If the teacher takes up a subject, not obviously grist for the great mill, the students cease to listen, and leave his classes. The instant he says something which sounds like an examination "tip," every ear is erect, every pen takes down his words. The keen student of to-day is getting like the reporter of an evening journal: eager after matter that will tell,

will make a good "answer," capital examination "copy." The mill governs the whole period of education, from *hic, hæc, hoc,* to the final launch in a profession. I know little boys of ten, in the *ego et Balbus* stage, who are being ground in printed examination papers which I could not answer myself. And big men, older than Pitt when he governed England, or Hannibal when he commanded armies, are still ruining their constitutions by cramming up "analyses" and manuscript "tips" of great "coaches." The result is that poor little urchins in frocks are in training for some "nursery stakes," as an old friend of mine used to call the trials of preparatory schools. The prize school-boy who sweeps the board on speech-day, often gets a perfect loathing for books, and indeed for any study that is not "cramming"; and the youth who leaves his university, loaded with "honors," may prove to be quite a portent of ignorance and mental babyishness. He has learned the trick of playing with a straight bat the examiner's most artful twisters. But he can not bear the sight of a book; and, like any successful speculator, he has a hearty contempt for knowledge.

Examiners are very clever men; but they ought not to form a sort of Continental "Ministry of Education," controlling on one uniform and mechanical scheme the entire field of education. Examining is more irksome, less continuous, and worse paid than teaching. Hence, as a rule, the professional examiners are hardly men of the same experience, learning, and culture as the professional teachers in the highest grades. They have not devoted themselves to special subjects of study; they do not know the peculiar difficulties and wants of the student; they are not responsible for the interests of a given branch of learning. A body of professional examiners, moving about from great educational centers, tend to give a uniform and regulation character to all learning. Our educational centers are yet in far too chaotic and changing a stage themselves to justify them in stereotyping any system. Knots of clever, eager, trained "experts" in the examining art are being sent about the country from Oxford and Cambridge, marking, questioning, classing, and certifying right and left, on a technical, narrow, mechanical method. They would be far better employed in learning something useful themselves. As it is, they dominate education, high and low. They are like the *missi dominici* of a mediæval king, or the legates *a latere* of a mediæval pope. They pitch the standard and give the word. Public schools revise their *curriculum*, set aside their own teachers, and allow the academic visitor to reverse the order of their own classes. The mill sets a uniform type for the university. Colleges give way and enter for the race. One by one the public schools have to submit, for prizes are the test; and success

means prizes. Next, the minor schools and private schools have to follow suit. And at last the smallest preparatory school, where children in nursery-frocks are crying over *qui, quæ, quod,* has to dance the same *tarantela.*

For this state of things the remedies seem to be these: Let examinations be much fewer—they are ten times too numerous. Let them be much more free—they are over-organized, over-regulated. Give examiners more time, more discretion, more room. The more the teachers are themselves the examiners, the better; the less examining becomes a profession and a special staff, the better. Do not set examiners to test teachers as well as students; do not set up mechanical rules whereby to test the examiner. Believe that it is possible to learn without any prize, money, or reward in view. Trust the teacher; trust him to teach, trust him to examine. Trust the examiner, and do not set up a mill. Above all, trust the student. Encourage him to study for the sake of knowledge, for his own sake, and the public good. Cease to present learning to him as a succession of races, where the knowing ones may land both fame and profit.—*Nineteenth Century.*

SKETCH OF JOHN B. STALLO.

JOHN B. STALLO is among the notable examples which this generation presents of men who, while busy in professional and public affairs, have at the same time shown themselves masters in scientific and philosophic thought. His published essays have given him place among the foremost thinkers and critics of his time, while he has achieved an equal eminence in his career of law and politics. In introducing the first of a series of his articles which afterward resulted in the "Concepts," the late Prof. Youmans remarked in the "Monthly" for October, 1873: "It has long been the honor and boast of the British bar that Mr. Justice Grove, the author of 'The Correlation of Forces,' belonged to it; it is equally to the credit of the legal profession in this country that a member of it has cultivated scientific philosophy to such excellent purpose as is proved by the articles we are now publishing."

JOHN BERNARD STALLO is of German origin, and was born at Sierhausen, Oldenburg, March 16, 1823. His ancestors, on both his father's and mother's side, were schoolmasters, and all of them persons of only moderate means. He inherited, particularly from his father's side, a thirst for knowledge and an inclination to scientific studies. These traits were particularly marked in

his uncle, Franz Joseph Stallo, who, while a prosperous book printer and binder at Damme, made a number of useful discoveries in physics and mechanics. He is accredited with having introduced peat-burning and the cultivation of buckwheat into his district, and with having promoted the irrigation of the heaths and the sowing of fir-seeds upon them, whereby they were transformed from barren moors into profitable pine-woods. He finally, however, began to advocate views that brought him into conflict with the authorities, and emigrated, followed by a number of his countrymen, in 1831, to the United States, where he attempted to found a colony at a place to which he gave the name of Stallotown, in Auglaize County, Ohio. His career and the prosperity of the colony were cut off, two years afterward, by the ravages of the cholera.

Mr. Stallo's grandfather, an honorable old Friesian, although he had passed his seventieth year when he became his grandson's teacher, took a great interest in the child's development, and rejoiced not a little when he found him, before the end of his fourth year, able to read and to work out simple arithmetical examples. His father gave him particular instruction in mathematics, his favorite study, and took care that he should learn the ancient languages, and French as well—which, out of respect to the old gentleman's national prejudices, had to be taught secretly from the grandfather. In his fifteenth year, young Stallo was sent as a free pupil to the normal school at Vechta, where he also enjoyed the advantage of the instructions of the professors in the gymnasium—an institution in high repute. In a short time he had gained sufficient knowledge of the languages and mathematics to fit him for entrance into the university, but his father had not the means to send him there. The alternative was then presented to him of continuing the chain of schoolmasters in his family, or of emigrating to America. He chose the latter.

He came to this country in 1839, bearing letters of introduction from his father and grandfather to clergymen and teachers in Cincinnati. He at once found a position in a private school in that city, and there he composed and published his first literary work, a German spelling and reading book, which appeared without an author's name. There had been great need of such a book in the lower school classes, and, as this one seemed admirably adapted to its purpose, it soon became popular and passed through many editions. It attracted the attention of the directors of the newly founded Roman Catholic St. Xavier's College, and they, finding also how good a mathematician the author was, appointed Stallo Professor of the German Language, to the duties of which post were added also those of teaching mathematics and the ancient languages. Physical and chemical sci-

ence being highly esteemed in this institution, and its library being well supplied with books on those subjects, Stallo improved his leisure hours in studying them.

In the fall of 1843 Mr. Stallo became Professor of the Higher Mathematics, Physics, and Chemistry in St. John's College, Fordham, a position which he held till 1847, when he returned to Cincinnati and entered upon the study of the law.

He was admitted to the bar in 1849, and came rapidly into a large practice. In 1853 he was appointed by the Governor of Ohio to fill a vacancy caused by the resignation of Justice Stanley Matthews as judge of the Court of Common Pleas of Hamilton County, and was elected by the people in the same year to that office for the full term. After discharging the duties of this position for two years, with satisfaction to the bar and the public, he resigned it in 1855, in order to continue his more lucrative practice. He thus lived, an eminent and respected citizen of Cincinnati, one of whom the German element especially was proud, prominent in the rational discussion of all questions of public interest, and active in all measures for advancing the public welfare, till, in 1885, he was appointed by President Cleveland to be the diplomatic representative of the United States at the court of the King of Italy.

According to Koerner's "German Element in America," the study of the higher mathematics, in which his professorial positions engaged him, led him logically to the investigation of the German philosophy, and consequently to the cultivation of those habits of thought which are exemplified in his principal published works. The first fruit of these reflections appeared in the book entitled "General Principles of the Philosophy of Nature, with an Outline of some of its Recent Developments among the Germans, embracing the Philosophical Systems of Schelling and Hegel, and Oken's System of Nature," which was published in Boston in 1848.

The credit is given to this publication, by an eminent scientific author, of having marked an epoch in the education of American thinkers. The views then expressed by the author have been modified and in part rejected by his riper experience; but they were not the less full of suggestion and inspiration, giving a new conception of nature, and opening unexplored vistas of thought to the student. This was at a time when the conception of unity and organic plan in nature, though already seen by poets like Goethe, had scarcely entered into the minds of English-speaking students of science. The second part of this early volume of Stallo's was not less welcome to such inquirers from the fact that it included brief expositions of the philosophic views of Kant, of Fichte, and of Schelling, serving as

an introduction to a more complete analysis of Hegel's system than had yet appeared in English. To all this was added a carefully digested summary of the physiophilosophy of Lorenz Oken, a work then unknown to most English and American students, although an authorized English translation of it appeared at about the same time, published by the Royal Society, and its views were already influencing the teachings of Richard Owen, of London, then the great master in natural history.

Speaking of this work in the preface to the "Concepts," the author says that it was written when he "was under the spell of Hegel's ontological reveries; at a time when I was barely of age, and still seriously affected with the metaphysical malady which seems to be one of the unavoidable disorders of intellectual infancy. The labor expended in writing it was not, perhaps, wholly wasted, and there are things in it of which I am not ashamed, even at this day; but I sincerely regret its publication, which is in some degree atoned for, I hope, by the contents of the present volume."

A personal friend of the author's describes the book as characterized by an erroneous method, resulting from the passion for freedom in thought and inquiry which was unconsciously its impelling principle—a work composed "in his philosophic heyday, when he tried to turn his conceptions into corresponding facts, to discover truth by creating it."

The work has, nevertheless, left its mark in scientific literature. The direction given by it, both by Stallo's own outline of philosophy and by his introduction to the thoughts of the great German thinkers represented in it, was soon apparent in the writings of several of the new generation of students. In none, perhaps, is this more clearly shown than in the writings of T. Sterry Hunt, whose papers from 1852 bear frequent evidence to the great influence of Stallo's teachings. It is worthy of note that Dr. Hunt's recent work—"A New Basis for Chemistry"—is dedicated to J. B. Stallo, "citizen, jurist, and philosopher," and that the author says in his preface that the volume in question was at that early period a source of inspiration to him.

The results of Judge Stallo's riper thought were given in his second and, so far, his greatest book, "The Concepts and Theories of Modern Physics," a work which at once gave him a world-wide reputation and placed him in the foremost rank among scientific thinkers. The development of the views embodied in this book can be traced, we think, in the author's occasional addresses and his contributions to periodicals in the English and German languages, of which we have only a few at hand; but those few present evident foreshadowings of what was afterward to be given permanent form in the "Concepts." Among them are a

paper on "Materialism," contributed apparently as a part of a series of "Philosophical Researches" to the periodical "Atlantis" in 1855; a memorial address on Alexander von Humboldt (1859); the earlier papers of the "Concepts," which were published in "The Popular Science Monthly" in 1873 and 1874; and a "Reply to some Criticisms on the 'Concepts,'" in a later number. In introducing the first of the articles in the "Monthly" (October, 1873), which was on "The Theory of the Atomic Constitution of Matter," the editor of this journal, Prof. E. L. Youmans, said, "The depth and force of the criticism are only equaled by the clearness of the conceptions and the precision and felicity of the statement."

This work is a thoroughgoing criticism of the theories and concepts by which modern scientific philosophy seeks to coordinate the facts of physics, chemistry, and astronomy. In the main this philosophy assumes all phenomena to be reducible to mechanics, and holds that the ultimate elements at which physical analysis arrives are mass and motion; the physical unit being an atom, hard, inelastic, inert, and passive. Since the concept of atoms defines them as absolutely simple, it follows that they must of necessity be equal. Yet here chemistry at once speaks in contradiction, for the atoms, or units, currently so named, differ radically in properties and characteristics. In a review of modern theories of the phases of energy, or modes of motion, we are shown the difficulties which attend the assumption of an ether as the vehicle whereby radiant energy is transferred. From the instantaneous propagation of gravitation through space, it is argued that no medium whatever may be needful for its communication. The kinetic theory of gases is next examined, which theory is shown to involve greater difficulties than it clears up. Next in order the author proceeds to define the conditions of true hypothesis, which in his view should both accord with all known facts and simplify them. He shows how modern theorists have neglected this canon, and supposed they were explaining a fact when they were only dwarfing it, or stating it in new terms. He finds more difficulty in understanding an atom than the mass which it goes to make up.

No portion of the "Concepts" is more striking than its chapter on the relation of thought to things. We are pointed to the fallacy which makes mind the measure of nature, and conceivability the test of truth. The author demonstrates how the historical order in which human knowledge has arisen has largely molded scientific conceptions—for example, in its being supposed that the solid form of matter, the first known and most familiar, is more simple than the gaseous. And because impact is the common mode of propagating motion, ideas as to the propagation of

motion universally are curiously limited to the conception of impact. Although the influence of the metaphysics of the middle ages is nominally discarded by modern scientists, yet that influence is distinctly traced in their modern seeking after the absolute in time, space, and motion. This, too, while it is clear that relativity is the law of both nature and thought. Judge Stallo concludes his book with a caustic criticism of the theory that space can exist in more than three dimensions. That theory he shows to involve the attribution to space of the very properties by the absence of which alone it is distinguishable from matter. He avers the search for properties in space, pseudo-sphericity and the like, to be without warrant from physics, mathematics, or logic.

While thus subjecting modern hypotheses to radical and often adverse criticism, Judge Stallo never for a moment drops into an injudicial tone. Such partial and tentative value as these hypotheses may possess he cheerfully accords them, but he maintains that the progress of individual sciences has far outstripped the unifying power of a philosophy whose roots are imbedded in ancient and discredited metaphysics. Throughout his life the themes treated in the "Concepts" have occupied the author's mind, and been the objects of his study. He may in the future present further consideration of the fundamental problems of scientific philosophy, as a sequel to the "Concepts."

It was to be expected that such a volume as the "Concepts" should have a noteworthy reception in the world of science, and at the hands of leading reviewers. Mr. A. W. Reinhold, in the London "Academy," commended it highly. So did "The American Engineer's" critic. Prof. Tait, in "Nature," and the reviewers of the "Critic" and the "Nation," did not admire its analysis, or deem its conclusions sound.

A close friend of Judge Stallo's, who has furnished us with an analysis of his character—Mr. C. H. Goddard, of Marietta, Ohio—credits him with great facility in turning from the study of one thing to the study of another; in learning retentively all kinds of facts, principles, opinions, hypotheses, and words; in analyzing these and using the results of his analyses; and in expression, whether by speech or in writing; "but only an intimate friend," he adds, "could appreciate the seemingly effortless impulse with which he has done the most that he has accomplished outside of his legal practice." He is distinguished among his friends by the breadth of his sympathies, and this is exemplified in many personal and patriotic attachments, and acts growing out of them; in freedom from envy or jealousy, and in the catholicity of his æsthetic tastes; but in nothing more than in his love for knowledge and for rational freedom. Of these, his love for rational freedom

is dominant. He has always been ready to leave the search for knowledge to go to the defense of freedom of thought and action, but never to give that up for any other consideration. This trait has been shown publicly in his answer to Orestes A. Brownson's attack upon the Hungarian revolutionists; in his eulogy of Thomas Jefferson as an apostle of the rational freedom of individual men in government; in his speech, after the Republican presidential nomination of 1856, when he urged his fellow-Germans to support Fremont; in his argument against the assumption that our Government is founded upon the Christian religion, as in derogation of the rights of non-Christian citizens; and in many other addresses and in newspaper articles and law cases.

It was also strikingly manifested in his presiding over a public meeting addressed by Wendell Phillips, when the orator was made a mark for missiles, and Judge Stallo stood by his side and bore the brunt of the assault with him. This was in 1862, when Mr. Phillips was invited to speak in Cincinnati in favor of emancipation. A bitter prejudice existed against him because he had been a disunionist. Judge Stallo had been invited to introduce him, but declined, because, his sympathies never having been with Mr. Phillips, he was not the proper man to perform that office. But when he was informed that other men whom he had mentioned as more suitable had declined, because they were afraid of a mob, he consented, saying, "That is enough, gentlemen—I will be there." Mr. Phillips, after being introduced, was at once assailed with a shower of disagreeable and dangerous missiles. One of them hit Judge Stallo. "During the turmoil and uproar," said Judge Stallo, telling the story several years afterward, "Mrs. Stallo, with Mrs. Schneider, sat behind a fellow who had risen and aimed a big stone at the speaker. As he threw his hand back to fire the stone, Mrs. Stallo, who entered heart and soul into the spirit of the hour, and had no thought but to stand by her friends in the stormy crisis, reached over and hit the fellow's wrist a hard blow, making him drop the stone and howl with pain. He looked around to see his assailant, and Mrs. Stallo was up and ready for him, but gentlemen hastened to her side, and the fellow moved away." In the law case of Rothgeb *vs.* Mauck and Others, Judge Stallo maintained the right of an infidel to have a temperately worded declaration of his sentiments recorded upon his tombstone and admitted to the cemetery. In a case in which certain action of the Board of Education of Cincinnati was involved, he opposed the enforcement of the singing of hymns and the reading of the Bible in the public schools, because they were objected to by a part of the citizens who were taxed to support the schools. The reading was enjoined by the

local Superior Court, but this decision was overruled by the State Supreme Court.

Judge Stallo's liberality has likewise been exemplified, Mr. Goddard says, "by his political relations, by the ease with which he would change from supporting to opposing, or from opposing to supporting, one of the existing parties, or keep aloof from political action, or help to form a new party, and yet show adhesion to well-rooted convictions." His attitude toward politics is compared in Koerner's "German Element" to that of the tangent to the circle, which only touches it at one place; he has entered the political field as if from without, only on great vital questions, but then works indefatigably in support of what he considers the right views, by word and writing. He was a Democrat till the contest arose over the extension of slavery into the Territories, 1854–1856, through which and through the war he ardently supported the Republican side. He co-operated with the Liberal-Republican movement till Greeley was nominated, when, finding his views on the tariff antagonized by the candidate, he withdrew from its further support. He advocated the election of Tilden and of Cleveland, in the belief that the time had come for a change in administrative policy.

In the days of his life in Cincinnati, Judge Stallo was accustomed to pass his evenings at home, in his library, in social intercourse with his family or such friends as might call in, where he would converse, Mr. Goddard tells us, in English, German, or French, as his interlocutor might prefer, on whatever subject might come up; and with great interest on the discoveries and tendencies in natural science and mathematics, or questions of philosophy, or of political and social interest at home or abroad, or on history and art and literature and men. While not all men could enjoy his favorable opinion, of some he spoke with great reverence, especially of Darwin, whose whole bearing toward truth and toward other scientific men called from him the expression, "I have many heroes, but Darwin is my saint." These conversations were often illuminated by bright flashes of wit, and illustrations drawn from extensive reading; but, whatever his subject or mood, his talk was simple and direct, and marked him versatile and acute, learned and accomplished.

CORRESPONDENCE.

THE FLYING-MACHINE PROBLEM.

Editor Popular Science Monthly:

SIR: To the greater part of Prof. Le Conte's article, "The Problem of a Flying-Machine," in the November number of "The Popular Science Monthly," I give hearty assent, and yet I can not admit that his premises warrant his very discouraging conclusions. He shows clearly that as the animal, flying or walking, increases in size, the ratio between power and weight grows smaller, until finally the limit of muscular strength is reached; or the "weight overtakes the utmost strength of bones to support or muscles to move." He shows that, among mammals, this limit was probably reached in the gigantic dinosaurs; and that the largest flying-birds, such as the turkey-cock and condor, are "evidently near the limit," and that the ostrich and emu have passed it, and hence are unable to fly.

He then speaks of the wonderful efficiency of the animal machine as a means for turning heat into work. "Nerve-energy acting through muscular contraction, and supplied by the combustion of foods, such as oils, fats, starch, sugar, and fibrin, together form the most perfect and efficient engine that we know anything of; i. e., will do more work with the same weight of machinery and fuel. . . . A bird is an incomparable model of a flying-machine. No machine that we may hope to devise, for the same weight of machine, fuel, and directing brain, is half so effective; and yet this machine, thus perfected through infinite ages by a ruthless process of natural selection, reaches its limit of weight at about fifty pounds. . . . The smallest possible weight of a flying-machine with necessary fuel and engineer even without freight or passengers, could not be less than three or four hundred pounds"; and hence Prof. Le Conte concludes that "since the animal machine is far more effective than any we may hope to make, therefore the limit of weight of a successful flying-machine can not be more than fifty pounds," and that a "*true flying-machine, self-raising, self-sustaining, self-propelling, is physically impossible.*"

Can this be so? Is the animal machine more effective than any we can hope to make? Will it necessarily "do more work with the same weight of machinery and fuel"? Does the limit of weight in a flying animal mark the limit for a flying-machine? At the risk of not being considered "a true scientist" I must decidedly dissent from these views; I can not look upon machine-flight as a real impossibility, similar to the production of perpetual motion or of a self-supporting arch of indefinite length.

Before making a comparison between the power of birds and motors, we must get some idea of the power exerted by the former. How much work must a bird of given weight actually do in order to raise himself from the ground and fly? It is well known that, once in the air, the power required is very much less than that necessary for rising. How much less is uncertain, but in a brisk wind an eagle, or condor, or albatross will circle around for hours, hardly ever flapping his wings, and seemingly the only work is that due to muscular effort in keeping the wings outstretched. The work done in getting up is, then, the greatest the bird or machine would be called upon to do. This work will evidently depend upon the ratio of the wing-surface to the weight; with wings only a square foot in area, the most powerful condor could not fly; and the greater the wing-surface, provided the muscles are strong enough to manage it, the less the power required.

This ratio has been measured on many birds. The vulture, for example, can spread 0·82 of a square foot for each pound of weight, and, assuming the entire weight to be thirty pounds, the total wing-surface would be 24·6 square feet.

We now have a ready means for calculating approximately the maximum power such a bird must be able to exert. In order to rise vertically, he must force the air downward until the reaction is equal to his weight. Calling v the velocity of the air in feet per second, R the reaction in pounds, w the weight of a cubic foot of air, A the area of wing-surface in square feet, and g the acceleration due to gravity, we may make use of the well-known formula for reaction: $R = \frac{A w v^2}{g}$ or $v = \sqrt{\frac{R g}{A w}}$, from which, substituting values, we find the necessary velocity to be about twenty-three feet per second. The work done in giving the air this velocity would equal $\frac{R v}{2}$, or three hundred and forty-five foot-pounds per second, equivalent to about six tenths of a horse-power. It is here assumed that the air is driven downward in parallel streams; but a bird's wing would naturally send off a part in other directions, and consequently the power necessary would be somewhat greater. Allowing twenty-five per cent for this and other losses, we see that a vulture weighing thirty pounds would not need to exert more than three quarters of a horse-power, and this only for a few moments while rising.

Suppose, now, our flying-machine to weigh six hundred pounds, or twenty times

as much, with the same ratio of wing or propelling surface to weight; we should then require simply twenty times more power, or about fifteen horse-power.

There are, I think, few engineers who will assert such a concentration of power impossible, even when the weight of the man, and fuel for a considerable space of time, are included. Indeed, Strongfellow is said to have, years ago, built an engine and boiler complete which gave a third of a horse-power for a weight of twelve pounds, or weighing only at the rate of five hundred and forty pounds for fifteen horse-power.

Prof. Le Conte shows clearly that with birds "the ratio of weight to strength, and therefore the difficulty of rising, *increases* as the size or weight"; but in a machine it is well known that the above ratio *decreases* as the weight; or, in other words, we can get a hundred horse-power with a much smaller ratio of weight to power than is possible with a single horse-power.

Even now, using iron and steel and steam, we can concentrate power until we can match the energy of a bird; but, by the substitution of aluminum, possessing equal strength and weighing only a third as much as steel, why should we not hope to do much more than that?

Possibly as a heat-engine the animal machine is more efficient than the best steam-engine, although, nowadays, the "Cornish" can hardly be accepted as a standard of excellence; but it seems to me the problem is one of concentration of power, rather than economy. Surely Prof. Le Conte must be mistaken in thinking we can not equal the birds in this respect. He underrates the capacity of our engineers.

The size of a bird is no doubt limited by the strength of bone and muscle, but we are not confined within anything like such narrow limits. The huge dinosaur had reached Nature's limit of size for a walking-machine; but compare him with man's conception—the locomotive—weighing eighty tons and giving out the power of more than eight hundred horses! The whale appears to mark Nature's limit of size in marine animals. Compare him with our ocean-steamers, indicating fifteen thousand horse-power, and propelled by an instrument vastly more efficient than anything Nature has provided!

Why, then, should we be limited in our flying-machine to the weight or size of the largest bird? Surely, if we can produce in it an equal or greater ratio of power to weight, and can command the use of materials strong enough to stand the strain, we are not restricted as to size.

Nor are we limited in a machine to the birds' way of flying. The leverages of the muscles moving the wings are necessarily short and the strains great, but no more than in a steam-vessel are we bound down by Nature's methods. We may very likely be able, in some ways, to improve on her model.

Even were we to admit Prof. Le Conte's claim that the animal machine can "do more work, with the same weight of machinery and fuel," than anything "we may hope to devise," our engineers need not feel discouraged; for the power required in rising from the ground is manifestly much greater than that necessary for flight, and why should we not be able to take advantage of this by starting from some elevated point, and slide down and up aërial inclines after the manner of a bird? He then apparently does not need do a great deal of work, and why should a properly constructed machine?

The problem is a difficult one, but I can not help thinking Prof. Le Conte at fault in placing its solution among the "impossibles."

T. W. Mather.

New Haven, Conn., *December* 6, 1888.

DO ANIMALS "PLAY 'POSSUM"?

Editor Popular Science Monthly:

Sir: Walking by a broad ditch, I saw a large, dark-colored snake gliding along the bottom under the water. The creature was coming directly toward me; but as I paused to observe its markings it stopped, raised its head to the surface, and remained motionless. Its back was marked with a pattern of criss-cross curves of pale yellow on a ground-tint precisely like that of water-soaked wood. Presently I began to throw little stones, to make it move on, but it did not stir. Meanwhile, the circles caused by my plashing missiles, the ripple-marks on the sandy bottom, the similar curves on the snake's back, and the crooked, lead-colored neck, all combined to pass off the animal for a water-logged stick. It would have been difficult at that moment to have convinced an inexperienced observer that it was a live snake.

This effect raised the question whether the creature was aware how nearly indistinguishable it had become. It is the common opinion that animals "play 'possum"—i. e., remain passive and apparently helpless under attack—for the purpose of safety, while they are entirely alert and would much prefer to run away. But is this theory credible when we take into account the immense self-control it demands? And can we credit such a seemingly stupid animal as a snake with sufficient intelligence to select deliberately a mode of defense requiring so nice a perception of its own appearance as well as its surroundings? Dr. Abbott thinks that the well-known behavior of the opossum when attacked is due simply to paralyzing fear, and he supports his theory by many careful observations. If it is true that the opossum *faints* with terror in the presence of danger, it seems probable that, in the case of other animals, what looks like intelligent dissimulation is really due to helpless

fright. If we human folk are sometimes "too scared to move," why not the lower animals also? S. F. GOODRICH.

GENEVA, OHIO, *September* 5, 1888.

INSECT FERTILIZATION OF FLOWERS.

Editor Popular Science Monthly:

SIR: I have been reading Mr. Grant Allen's very interesting article in the October (1888) number of "The Popular Science Monthly," and, with your permission, I wish to set him right on a few points. On page 732 he says: "A wandering bumble-bee, on dinner intent, poked his long proboscis into pea-flower number one, and, after rifling it of its honey, covered his hairy legs and thighs, half accidentally, with abundant pollen." Why *half* accidentally? The bumble-bee knows nothing about the needs of the pea-family, and when it carries the fertilizer from one blossom to another it does it altogether unconsciously and *wholly* accidentally. Then, again, on page 736, he says: "Now, in the higher plants we get exactly the same sort of combination. . . . If we take any annual plant, like the pea, and look when and where the flowers are produced, we shall see that they come as soon as the plant has attained its full growth, and when the purely vegetative reproductive impulse is beginning to fail." This is not true. The pea begins to blossom at least two weeks before it has its full growth. Many kinds of pea-plants will be as tall again when they begin to decay as they are when they begin to bloom. And it is not the flowers of the pea-vine that use up its strength and cause it to decay, but the maturing and ripening of the seed. Of course, the pollen must strike the pistil at the right time, or no seed is the result, but this pollen does not come in with any reference to the needs of the plant; it comes to answer the needs of the seeds. Again, on page 739, in speaking of the hybrid orchids, he says: "Some wandering bee, visiting a flower of the yellow orchid at this spot where I stood, had carried away on its head gummy pollen-masses, and then, contrary to the common habit of bees (who generally visit only one particular species of plant at a time), had deposited them on the stigma of a neighboring brown specimen. I suppose he was a young and inexperienced insect, who had not yet learned to avoid the bad practice of mixing his honeys. From this chance fertilization any number of hybrids had taken their rise," etc. It is not true that bees only visit one species of plants on each trip. Bees will go from the red to the black-cap raspberry and gather honey from both; and from our sweetest and best grafted apple-trees to the green, bitter, wild crab. Because bees and insects do go helter-skelter among the flowers, we are always budding and grafting, and are never sure of any of our fruits that come from the seed. To prove this, let any one take some flour and stand among the red and black-cap raspberries where they grow close together, when the bees are *roaring* around them; put some flour on a bee's back, and then watch it go from blossom to blossom. I think it must convince the most skeptical of two things: First, that bees work on different species; and, second, that bees know nothing, and care less, about the good of the species.

I say it is *not* true that bees work on the same species while on a trip after honey or pollen. I *claim* much more than this. They work on the flowers of different families. To prove this, go into a garden of flowers during a dearth of nectar and watch the bees go from flower to flower. They will fumble around among the petals of any blossom that contains either pollen or nectar, mechanically and indiscriminately.

Respectfully yours,

MAHALA B. CHADDOCK.

FREMONT, ILL., *November* 27, 1888.

WOMAN SUFFRAGE.

Editor Popular Science Monthly:

MR. CRAMER'S condensed and categorical criticism in your January issue, of my article on this subject, which appeared in the "Monthly" of last October, deserves a reply from me, since his method is direct, and some of the points he raises will bear further ventilation.

First, as to the physical inability of women to take part in the execution of the laws. This I have thought, in common with many other men, to be a sufficient reason why women are not adapted for taking part in government. We are reminded, in reply, that but a portion of the male sex are required to serve in the army, and none beyond the age of forty-five years in this country; and we are told (not for the first time) that, if we disfranchise on this account, we must deprive of the suffrage our most thoughtful class of voters, our older men. This answer is no doubt an honest one, because its refutation is so easy that it would not be brought forward by any one who can see the situation as it is. The situation is simply this: that in all countries, notwithstanding the forty-five-year limit in this one, men will be called on to do military service, when the case requires it, as long as they can walk and carry a gun. Moreover, it is not chiefly as soldiers that men are liable to do duty in the execution of the laws. Any and all men may be called on by the sheriff of the county to serve as *posse comitatus*. Moreover, all our civil government rests on the police and judicial system, and not a single one of the preliminary steps in the process can be performed by women. Not a man could be arrested, taken to prison, taken to the court-room, or to punishment, without a male police. Since women can not act in any of these capacities, nor yet as

judges, it is evident that the enactment of laws by women, to be executed by men, is government "by women alone." It was in this sense that I used that expression, and not as a question of arithmetic.

Government is in fact the government *of men by men*. It is men who do things, and, among other things, they are the most frequent law-breakers. It takes men to govern men, and what governs the greater force will control the lesser. It is not necessary to cut two holes in the gate, the one for the large, the other for the small cat. The small cat can go through the large hole.

E. D. COPE.

PHILADELPHIA, *December* 26, 1888.

EDITOR'S TABLE.

ALTRUISM AND EGOISM.

THE question of the proper balance to be maintained between altruism and egoism is one of much practical importance. A certain view of the subject was presented in the paper by Mr. Charles W. Smiley, published in our November number, and a different, to some extent an antagonistic one, was maintained in the letter from Prof. Bulkley, of Washington, which appeared in our number for January. We have already expressed a general approval of Mr. Smiley's position; but, in view of the counter-arguments of our recent correspondent, we may perhaps be allowed a few additional words of explanation.

The question, as it seems to us, is not which is the higher principle of action —altruism or egoism—but the much more practical one as to the extent to which, and the circumstances under which, one human being should gratuitously supplement by his own industry or capacity the deficiencies in one or both these respects of another human being. The early Christians, we read, had all things in common: no one said anything was his own; all individual property was abolished, as completely as P. J. Proudhon himself could have wished. Somehow or other this state of things did not continue long; and Christians of the nineteenth century show no particular desire to revert to this feature of the early church. We may therefore claim that personal ownership of property is recognized to-day as a good thing. If, then, any one is called upon to part with a portion of his goods for the benefit of others, some adequate reason should be shown for his doing so. It is not enough to tell him that altruism is a virtue; for that argument, unchecked by other considerations, would lead to the re-establishment of the very system of communism upon which it has been decided not to re-enter. Before he parts with his money for alleged benevolent objects, a reasonable man will require to have it demonstrated to him that its application in the manner proposed will cure more evil than it will, either directly or indirectly, cause. In order to judge the matter rightly, we should take the case of a man who, possessing wealth, is employing it in a prudent and useful manner, and, so far, helping forward the prosperity of the community; not the case of one who is squandering large sums of money in idle ostentation or vicious pleasures. In the latter case the man is doing harm with his money already, and possibly more harm than would be done even by injudicious benevolence. The former case, therefore, is the only one that enables us to bring a proper criticism to bear upon a suggestion for an "altruistic" application of wealth. The money is now being usefully employed in the industry of the country; and, so far as applied to the personal expenditure of its owner, is being used in maintaining a type of living that simply inspires respect, challenging neither the stupid admiration of the vulgar nor the envious regards of the poorer classes. It is evident that nothing short of a very satisfactory

demonstration of the superior usefulness of the proposed end would justify the transfer to it of capital already usefully and worthily employed.

Now, among the points to be considered in weighing such a question, this certainly should not be overlooked, that the altruistic act, while it may alleviate a given case of misfortune, tends to produce another case to replace the one relieved. Does any one ask how? By creating an expectation in the minds of others that their troubles will be lightened or removed in a similar manner, and so causing a certain relaxation of the effort by which a condition of helplessness might be averted. The probability is that not one only but several cases calling for charitable interference might be the result of a single stroke of charitable effort; just as a single prize taken in a lottery upsets scores if not hundreds or thousands of minds. We need not, however, theorize on the subject—though the theory on this occasion is nearly as demonstrable as a proposition in Euclid—for experience has proved over and over again that systematic "charity" makes beggars. The man, therefore, whose money is usefully employed, and who has nothing to reproach himself with on the score of personal waste, will have to be satisfied that the cases of want or vice that he cures—admitting that he cures them—will not be made up, or more than made up, by others resulting more or less directly from his benevolence.

But in how many cases is real good done to the so-called "beneficiaries" of charity? We have ourselves heard the most mournful confessions on this subject from persons who practiced altruism, or Christian charity, as they would perhaps rather have called it, from motives of religious duty. According to these statements, it is a comparatively rare thing to be able to record any solid advantage as resulting to the objects of such charity. But, if so, must not harm result? If we mistake not, the secretaries and other agents of our Young Men's Christian Associations could tell of hordes of shiftless, characterless creatures, interspersed now and then by some unctuous adventurer, who haunt their rooms in the expectation of relief, and who frequently get relief, but of whom no good is ever afterward heard. We do not deny that money may be expended in such a way as to do real good to those who need help; we only say that it is difficult so to expend it, and very difficult to guard against doing harm to others by weakening the motives for resistance to the habits that make for pauperism. Some large charity may seem a beautiful and admirable thing considered in itself; but we should not stop with this inside view. We are bound to ask what effect it is producing on society at large; and if a current is seen ever setting toward it, and virtually "*nulla vestigia retrorsum*"—no steps turned away from it—we must moderate our admiration of the function it is performing in the community.

It is common for sentimentalists to speak of natural selection as the very type of a "merciless law." But who will dare to say with confidence that natural selection is not more merciful, on the whole, than man's vaguely altruistic interferences with the natural course of things? Nature makes incompetence and misery short-lived, and reduces them in every way to a minimum. Man steps in and accuses Nature of cruelty; he tries his own hand, and, lo! thousands and hundreds of thousands are leading a languishing physical and a depraved intellectual and moral existence. The result is not one to be proud of. Man should love his neighbor. Truly; but that does not mean that he should undermine his neighbor's independence, or that he should injure half a dozen neighbors for the sake of benefiting one. As we understand Mr. Smiley, altruism is just as much in need of being kept within the bounds of reason as egoism. He would not discour-

age generous instincts; but he would oppose the idea that, because an act is altruistic, it must be good and virtuous. All altruism is interference, and interference needs to be justified. As we stated at the outset, people are too much accustomed to think of charity being given out of a surplus that would otherwise not be usefully employed; but that idea tends to disguise the real nature of the question. There is vast need for social reform in the matter of the expenditure of money; and indeed we know of no direction in which a moral crusade is more wanted. If something could be done to check the barbaric extravagance of our wealthy classes and the blamable extravagance of classes that are not wealthy, much good would be done to the whole body of society.

LITERARY NOTICES.

MEMORY: What it is and how to improve it. By DAVID KAY, F. R. G. S. "International Education Series," Vol. VIII. New York: D. Appleton & Co. Pp. 334. Price, $1.50.

WHATEVER may be the educational process by which knowledge is gained—observation, reasoning, or passive reception of text-books and lectures—it is retained by the one faculty of memory. This consideration is enough to show the great importance to the educator of a thorough acquaintance with the nature of this faculty and the best means of cultivating it. On the other hand, as Dr. W. T. Harris, the editor of this "Series," points out, the memory, when overdeveloped, may crowd and cramp the other faculties. It is a familiar statement that much memorizing deadens the power of thought, and it is equally true that the powers of sense-perception, imagination, and will may be paralyzed by the same means. "With an overactive memory we suppose ourselves to see in an object what we remember to have seen in it before, and any new features escape our superficial perception. This is true, too, in the case of imagination, the power which ought to be productive as well as reproductive." Hence the problem is not the simple one of how to strengthen the memory as much as possible, but how to train it so that it shall have its greatest efficiency and yet not interfere with the action of the other faculties. As to guarding against an overactive memory, Dr. Harris says: "The antidote for this baneful effect of memory is to be sought in a method of training that associates effects with causes, and individuals with species; that associates one idea with another through its essential relations, and not by its accidental properties. One must put thought into the act of memory." Beginning with an examination of the nature of memory, Mr. Kay proceeds to point out the connection between mind and matter in general, and especially the influence which bodily conditions have upon mental action; he next discusses the phenomena of sensation, and then describes the formation of mental images and the unconscious action of the mind. The author is convinced that much light is thrown upon the subject of mnemonics by the facts of physiology. "When one performs a set of movements," he says, "for the first time, he may find considerable difficulty in doing so, owing to the unadaptedness of the parts concerned. These parts, however, retain certain traces of what has taken place in them, so that when the movements come to be performed a second time the difficulty attending them is somewhat less." Frequent repetition increases the ease of performance. Similarly sensations leave their traces on our sense-organs; men observe best what they have frequently observed. Recalling to mind an act or sensation is so much like the original experience that, in the author's opinion, the same parts are concerned in the one as in the other, and the traces made by these experiences have something to do in the act of recollection. This view is supported by the recent theory that, in the words of Prof. Bain, "the organ of the mind is not the brain by itself; it is the brain, nerves, muscles, organs of sense, viscera." Our ideas are remembered in the same way, for "every idea in the mind must have entered it by some sense, and, in order to its full and complete recall, it is believed that it must be again projected or imaged in an organ of sense. Even the most abstract of our ideas are abstracts of sensations belonging to some sense which is also concerned in the recollec-

tion of them." In the concluding chapters Mr. Kay shows that, if the foregoing is true, "it is evident that, in order to improve the memory, special attention must be given to the training of the senses. This is to be done by first training them to observe carefully what is before them, and then making them recall or reproduce what has been presented to them, as accurately as possible. These two are distinct. The one depends on attention, the other on association and frequently recalling what is in the mind. In attention the great thing is to concentrate the mind upon one thing at a time till it is thoroughly mastered. In association we must seek to bring together and associate those ideas that most nearly resemble each other and that we wish to recall each other." The two processes of attention and association are involved in every act of remembering, and suggestions as to how they may be made more effective form the substance of the author's advice on how to improve the memory. Throughout the book the author makes prominent the bearing of his views on education, for he deems the treatment of the memory in the present system of education to be wholly wrong. "Instead of the communication of knowledge," he says, "being made the means of improving the memory, the interests of the memory are sacrificed in order that it may be crammed with as much knowledge as possible, without regard to the permanent injury that may thereby be done to it." The subject is evidently one on which the author has studied long and read widely; his presentation is simple and consistent, and his various statements are supported and illustrated by many brief quotations from eminent specialists in mental science.

WORKS OF THOMAS HILL GREEN. Edited by R. L. NETTLESHIP. Vol. III. Miscellanies and Memoir. London and New York: Longmans, Green & Co. Pp. clxi and 479. Price, $7.

MR. GREEN led a quiet life as a tutor and Professor of Moral Philosophy in the University of Oxford, seldom appearing before the public or engaging in movements that brought him into prominence, but he did much work that the world should not let be forgotten while the improvement of mankind and of government is sought. He is characterized by his biographer as a man in whom "philosophy was reconciled with religion on the one side and politics on the other; . . . to whom reason was faith made articulate, and for whom both faith and reason found their highest expression in good citizenship." His thoughts were directed toward practical measures for lifting the English masses into a higher physical and mental condition; and the reading of his essays shows him to have been a man of providential foresight, looking not to the present aspect, but to the remote, not yet seen, result. He was born in a small village in Yorkshire, in 1836, of Puritan descent; was schooled at Rugby, where he showed a tendency toward philosophizing; became a student at Balliol College, Oxford, where he obtained a degree and afterward a fellowship; and then worked as tutor and later (1878 to 1882) as professor. He was one of the "recognized politicians" of the Rugby school, and was considered, in spite of his protestations to the contrary, a "dreadful radical." In college, he made himself felt by his fellow-students, and showed his independence by following his own line of reading rather than pursuing honors and prizes. He regarded Louis Napoleon as a "successful brigand"; had an enthusiastic admiration for John Bright, whom he described as "a great 'brick,' simple as a boy, full of fun, with a very pleasant flow of conversation and lots of good stories"; read Wordsworth, Carlyle, Maurice, and Fichte; failed in the candidacy for a professorship at St. Andrews, Scotland, because he was charged with Comtism and materialism—to which he was really opposed; rejoiced in 1860 over the repeal of the paper-duty, because it would secure the position of the penny papers and destroy the despotism of the "Times"; was comforted with the sure prospect of Gladstone's becoming a radical, for he, Bright, and Cobden would "form a fine triumvirate to lead the people's cause"; and he sympathized ardently with the United States in the war of the rebellion, and saw clearly what was the real issue in the contest. In 1864 he was appointed a member of the Royal Commission on Education, and spent about a year, all told, in industrious personal inspections of the schools of five counties. The remarks in his reports, upon the condition of the schools and the

points in which the middle-class schools in particular failed to respond to the needs of those who should attend them, are very pungent, go down to the root of the matter, and look to the final and permanent result; and they show that his strongest sympathies were with the education of the middle classes, whom the universities were only just beginning to touch. This sympathy was intimately bound up with a sympathy with the non-conformists, which was expressed in a lecture before the Edinburgh Philosophical Institution on "Cromwell and the English Commonwealth." He supported electoral reform as a means of redeeming the government from the grasp of capitalists and snobs, and rejoiced over the passage of the conservative bill in 1868, as a victory in which no party was the winner, but the whole nation won "by a measure which makes us for the first time one people." What result was looked for from the enfranchisement of the people was not the present question. "Untie the man's legs, and then it will be time to speculate how he will walk." In one of his speeches he defined as the idea of a true liberal programme "the removal of all obstructions which the law can remove to the free development of English citizens." In a lecture respecting the position of the political reformers, he described them as proceeding "upon the principle that true political freedom means the power on the part of the citizens as a body to make the most and best of themselves, or (which is equivalent) to contribute equally to a common good, and that freedom of contract, freedom in all the forms of doing what one will with one's own, is only valuable as a means to freedom in its positive sense. No contract, then, is valid, which defeats the end for which alone society enforces contracts at all—i. e., that equal development of the faculties of all which is the highest good for all." On this principle he justified interference in matters of labor, health, education, the letting of land, and the sale of alcohol. The strongest elements in his nature "seem to have been the sense of public duty and the sense of religious dependence, and in the creeds of modern liberalism and modern evangelicalism he found a congenial language, which he had no difficulty in translating when he wished into that of German metaphysics. . . . The idea of a free personality, exercising its freedom under conditions which it has itself created, formed the meeting-point for his political and religious aspirations. In the light of this idea he interpreted to himself the problems of history, of morality, of theology." As he grew older, he found that with many of his natural allies, liberal politicians, religious enthusiasts, scientific investigators, he could only go half-way. But, with all modifications in his attitude, "the ideal of Christian citizenship remained his ideal to the end; and, in spite of frequent antagonism to the accredited representatives of physical science, he never relinquished the claim to be at one with the true scientific spirit." The subjects of Mr. Green's lectures, both as tutor and as Professor in Moral Philosophy, turned largely round certain works of Aristotle, to which parts of Plato were added. The manner of treating these works was gradually modified, in accordance with the methods of German commentators and writers like Jowett and Pattison, and became "less literary and more philosophical." The lectures which he delivered during the four years of his professorship were embodied in his "Prolegomena to Ethics," which was published after his death. A course on "Political Obligation" and parts of other courses have been published in the second volume of this edition; and that and the first volume contain the collection of his philosophical works. The present volume of "Miscellanies" contains twenty-one papers, which have been published as public addresses, as articles in the "North British Review" and the "Academy," or through other channels. Among the subjects are "The Force of Circumstances," "The Influence of Civilization on Genius," "The Value and Influence of Works of Fiction in Modern Times," "The Philosophy of Aristotle," "Popular Philosophy in its Relation to Life," "Caird's Philosophy of Religion," "Immortality," "Christian Dogma," "The English Commonwealth," "Liberal Legislation and Freedom of Contract," "The Grading of Secondary Schools," "The Elementary School System of England," "The Work to be done by the Oxford High School for Boys," and theological subjects.

ASTRONOMY WITH AN OPERA-GLASS. By GARRETT P. SERVISS. Illustrated. New York: D. Appleton & Co. Pp. 154. Price, $1.50.

UNDER the above title a series of five articles recently appeared in "The Popular Science Monthly," describing the aspect of the starry heavens as seen through that most available variety of the telescope—the opera-glass. These descriptions included directions for recognizing the constellations and the principal stars, and were illustrated with numerous star-maps and views of the sun and moon, while many allusions to the history and mythology of the subject added to the interest of the text. The articles called forth many lively expressions of pleasure, both from the newspaper press and from individual correspondents, which is not surprising, for the "Monthly" has seldom if ever published a series of papers whose scientific accuracy and fascinating style made them more deserving of the name of popular science than these. The series, rearranged and enlarged, is now published in book form. The volume contains an introduction, composed of matter recast from the articles in the "Monthly," devoted to telling what a good opera-glass is. This is followed by four chapters, devoted respectively to the stars of spring, summer, autumn, and winter, and a chapter on "The Moon, the Planets, and the Sun," the accounts of the planets being new. Throughout the work, and in some parts on almost every page, new matter has been introduced, intended to make the subject clearer and more interesting to the reader, and to render the book enjoyable and useful reading to those who may not care to follow out, opera-glass in hand, the directions and descriptions contained in it. Accounts of additional stars, star-groups, and other objects have been inserted, also fresh references to star-lore, as well as to advances in our knowledge of the heavens made since the series appeared in the magazine. The radiant points of some of the principal meteor-showers have been indicated; also the places in the heavens of the points known as the solstices and equinoxes. Additional descriptions have also been introduced of the revolution of the heavens and its effect upon the places of the constellations at different seasons and different hours. New matter has been added on the history of the Pleiades; about Sirius and Procyon, and their strange companion-stars; and about star-clusters. All the illustrations of the article on "The Stars of Spring" were redrawn and re-engraved for the book, and several new ones have been added in this chapter and in that on "The Moon, the Planets, and the Sun." The volume is printed in large, clear type, on fine paper, and is bound in a notably tasteful and appropriate style.

MICROSCOPICAL PHYSIOGRAPHY OF THE ROCK-MAKING MINERALS. By H. ROSENBUSCH. Translated and abridged by JOSEPH P. IDDINGS. New York: John Wiley & Sons. Pp. 333. Price, $5.

THIS work is described by the translator as containing all that is necessary for an accurate and complete determination of the rock-making minerals. In the first part of the volume the optical properties of minerals are described, with some account of their morphological characters, their phenomena of cohesion and chemical properties. In the second or descriptive part the minerals treated are arranged according to their system of crystallization, being divided into two groups, isotropic and anisotropic minerals. The former group comprises amorphous substances and those belonging to the isometric system; the latter group is subdivided into minerals with one optic axis (tetragonal and hexagonal systems), and those with two optic axes (orthorhombic, monoclinic, and triclinic systems). There are, besides these, a few crypto-crystalline substances, which are placed under the head of aggregates. Each section in the first part, and each species in the second, is preceded by a list of the literature of the subject. Twenty-six plates of photo-micrographs and one hundred and twenty-one woodcuts illustrate the text.

TOWN AND COUNTRY SCHOOL BUILDINGS. By E. C. GARDNER. New York and Chicago: E. L. Kellogg & Co. Pp. 129. Price, $2.50.

THE aim of this work is to aid improvement in a department where improvement has been sadly needed. School-houses have been like barns in the country, and like warehouses in the city, rather than fit places for children to exist and study in. The book

comprises a series of twenty-three designs for school-buildings, ranging from a log-house of one room to a brick building of two stories and basement, and containing eight rooms. Each design is accompanied by a general description, in which the lighting, heating, ventilating, and toilet arrangements receive due attention. The text is abundantly illustrated with front and side elevations, floor-plans, and details for doors, fireplaces, transoms, screens, porches, windows, belfries, gates, fences, etc. In all the designs the principle that school-houses should be attractive is insisted on, and their porches with balustrades, the low overhanging roofs, and exterior chimneys of many of them, make the smaller ones look like dwellings, while the large ones have the appearance of libraries or club-houses rather than the severe aspect usually associated with a school-house. Attention is paid to economy withal, especially in the designs for the smaller buildings. The book is very handsomely printed and attractively bound, and deserves a place in the library of every school officer.

ROCKS AND SOILS: Their Origin, Composition, and Characteristics. By HORACE E. STOCKBRIDGE. New York: John Wiley & Sons. Pp. 239. Price, $2.50.

THE object of this book is to present what aid the science of geology can furnish to the important art of agriculture. Some sixty pages are devoted to a sketch of the geological history of the earth, and an equal space to rock composition and decomposition. In this second division, the constituents of the most important crystalline and non-crystalline rocks are given, the disintegration of rocks by internal and by external forces is described, and the products of such disintegration are enumerated. The internal agencies mentioned are volcanoes, thermal waters, rock metamorphism, and contraction of the earth's surface manifested in gradual changes of surface-level, in mountain formation, and in earthquakes. The external forces of disintegration are change of temperature, mechanical and chemical action of water, action of the air, and of organic life. The remaining division of the volume deals with the further transformation of the disintegrated rock into soils by the incorporation of organic matter through the agency of plants and animals, with the constituents and characteristics of soils, and with the soil as related to the production of plants. Methods of experimenting with and analyzing soils are described here. An appendix contains tables of percentages of the constituents found in soils, agricultural products and mineral fertilizers, and these are followed by a list of authorities.

A MANUAL OF THE VERTEBRATE ANIMALS OF THE NORTHERN UNITED STATES. By DAVID STARR JORDAN. Fifth edition. Chicago: A. C. McClurg & Co. Pp. 375. Price, $2.50.

THE object of this manual is to give to students and collectors a ready means of identifying the vertebrate fauna, including marine species, of the region which it covers, and of recognizing the characters on which the families, genera, and species of these animals are founded. A system of analytical keys has been employed by which differential characters are brought into contrast. The present edition is wholly rewritten, and the order of arrangement is reversed, the lowest forms being placed first. The artificial characters largely used in the first four editions of this work for the analyses of the genera have been for the most part replaced by the less obvious characters on which classification is actually based. The region covered by the manual has been extended, so that it now includes the district north and east of the Ozark Mountains, south of the Laurentian Hills in Canada, north of the southern boundary of Virginia, and east of the Missouri River. In order to keep the book of moderate size, all descriptions have been made very concise, while synonymy and generally references to authority have been omitted. Prof. Jordan's name is a sufficient guarantee of the reliability of the work.

THE TARIFF AND ITS EVILS. By JOHN H. ALLEN. ("Questions of the Day." No. LIII.) New York: G. P. Putnam's Sons. Pp. 122. Price, $1.

IN this essay a ship-owner and merchant of long experience combats the theories of the protectionists as formulated by Senator John Sherman in his speech to the Home Market Club of Boston. The author natu-

rally devotes his attention chiefly to the effects of our tariff on our foreign commerce and our carrying-trade, the aspects of the subject with which his experience has made him most familiar. The author maintains that what prosperity we have in this country is obtained from our natural resources and in spite of the protective tariff rather than because of it; that the country is not so prosperous but that we have among us constantly a vast army of workers without work; and that the tariff closes to our products the foreign market, in which we might make large sales. The restrictive system has almost destroyed American shipping, and ship-owners are now looking for contributions from their fellow-citizens in the form of subsidies to enable them to carry on this unprofitable industry. The mill-owners get such contributions, and the ship-owners ask, Why should not we? The farmers, who number about half our working population, and are more than four times as many as the manufacturing workers, suffer severely from a system which protects their products about twenty per cent and taxes them on their purchases nearly seventy per cent. The author's positions are fortified by numerous pertinent facts and figures.

EATING FOR STRENGTH. By M. L. HOLBROOK, M. D. New York: M. L. Holbrook & Co. Pp. 236. Price, $1.25.

THIS book is a popular general guide on the subject of diet, not limited to the case of the athlete, as might be inferred from its title. Its language is simple, and, though scientific reasons are given for its directions, the volume contains nothing that the general reader can not understand. The first hundred pages are devoted mainly to telling the nature and value of the various classes of food-substances which we use, much of the information being arranged in the form of instructive tables. A plea for simplicity in living follows, enforced by the experience of persons who have lived for years wholly or mainly on fruit and vegetables. In the next chapter, the composition and value of each of the chief foods of the vegetable kingdom is set forth, the section on grapes including an account of the grape-cure. Some suggestions follow concerning diet for different ages, circumstances, and a number of specified diseases. The volume contains also several hundred recipes for wholesome foods and drinks, comprising soups, bread, eggs, vegetables, puddings, cake, and even pies, which the author says are wholesome or not as they are well or badly made; also the preparation of tea, coffee, etc., with cautions as to their use, and a variety of beverages from fruit-juices, milk, etc.

The Peter Redpath Museum of McGill University has issued a pamphlet on specimens of *Eozoön Canadense and their Geological and other Relations*, by Sir *J. William Dawson*, F. R. S. (Dawson, Montreal, 50 cents), the purpose of which is stated in these opening lines. "Whatever may be the ultimate decision of palæontologists as to the nature of Eozoön, it is important that the original specimens on which its description was based, and those later acquisitions which have thrown further light on its structure and have been published in that connection, should be preserved and catalogued. The collections made by Sir W. E. Logan are now for the most part in the Museum of the Geological Survey at Ottawa. Those accumulated by the author of these notes, as well as duplicates preserved by Sir W. E. Logan, are in the Peter Redpath Museum. It is to these latter collections that the present paper relates, and the object is to render them as useful as possible for scientific purposes in the future." The pamphlet is not a catalogue, though it contains a synopsis of the specimens to which it relates, but has the form of a monograph, the divisions of which are, geological relations, state of preservation, new facts and special points, notes on peculiar specimens, replies to Möbius, Hahn, etc., palæozoic fossils mineralized with silicates, phosphates, and graphite of the Laurentian, and a summary of arguments in support of the animal nature of eozoön. A bibliography of the subject occupies six pages, and sixteen cuts illustrate the text.

Parts II and III of Vol. II of *The Journal of the College of Science*, Imperial University, Tokio, Japan, have been received. Part II comprises three papers: "On the so-called Crystalline Schists of Chichibu," by Prof. Bundjiro Koto, Ph. D.; "On the Plants of Sulphur Island," by Prof. Samuro

Okubo; and "Some New Cases of the Occurrence of *Bothriocephalus liguloides*, Lt.," by Isao Ijima, Ph. D., and Kentaro Murata. Five plates illustrate these papers. Part III is wholly occupied by an account of "A Magnetic Survey of all Japan," carried out, by order of the President of the Imperial University, by Prof. Cargill G. Knott, D. Sc., and Asst. Prof. Aikitsu Tanakadate. The paper is accompanied by maps showing lines of equal magnetic dip, of equal magnetic horizontal force, of equal magnetic total force, and of equal magnetic declination; also charts of diurnal variation of declination, and two plates representing instruments.

Great-Circle Sailing, by the late *Richard A. Proctor* (Longmans, 35 cents), is a pamphlet "indicating the shortest sea-routes and describing maps for finding them in a few seconds." The routes may be found by the aid of one chart and a few lines of directions, but two charts are more convenient, and a dozen pages of explanation and illustration are given in addition. To meet the difficulty that the true great-circle course would often carry a ship into inconveniently high latitudes, the author gives Mr. Towson's method of composite sailing, which consists in taking a great-circle course to touch the highest latitude deemed safe, then following this parallel to a second great-circle course which passes through the port of arrival. Charts for this mode of sailing, eighteen inches in diameter, reductions of which are given in the pamphlet, may be obtained of the publishers.

We have received from Messrs. Thomas Prosser & Son, New York, *A Sketch of Alfred Krupp*, by *K. W.* and *O. E. Michaelis*, to which is added *A Visit to the Krupp Works at Essen*, from the French of Captain *E. Monthaye*. The sketch makes prominent the sturdy character of the man in forcing his way to success over enormous obstacles. A portrait of Krupp and views of his works are given.

One of the most effective contributions to the literature of tariff reform which has been made during the past year of active discussion is the pamphlet on *Relation of the Tariff to Wages*, by Hon. *David A. Wells*, in the "Questions of the Day Series" (Putnam, 25 cents). Taking as a text a statement by Mr. Blaine about "the condition and recompense of labor in Europe," Mr. Wells proceeds to show in catechetic form that the protectionists who try to work the "pauper-labor" scare "either mean to deceive, or do not know what they are talking about." The scheme of his argument is, first, that the position of labor is more favorable in the United States than in Europe because of the exemption from enormous military and tax burdens, the abundance of fertile land and of means of communication and transportation, the diversity of soil and climate, and the intelligence and energy of the laborers in this country; secondly, that, in proportion to the work done, American laborers do not receive more wages than European; next, that restrictions of markets restrict the opportunities for labor; then, that wages have not been reduced heretofore by reductions in tariff rates; that only five or ten per cent of the bread-winners of the country are engaged in producing protected articles; and, finally, that our present tariff policy is certain to reduce wages. The subject is presented in the clear and vigorous style which marks all of Mr. Wells's economic writings.

The very readable character of the pamphlet by *Henry J. Philpott*, in the "Questions of the Day Series," makes its title, *Tariff Chats* (Putnam, 25 cents), a remarkably fit one. The author points out that the tariff is a tax, and that it favors trusts. He gives figures to show how much it raises the prices of certain woolen, cotton, and iron manufactures, and charges with supreme selfishness the few who are benefited by the tariff at the expense of the many. In a striking table he shows that our wealth, manufactures, wages, and various other interests, advanced far more from 1850 to 1860, under a low tariff, than from 1860 to 1870, or 1870 to 1880, under a high tariff. That the high tariff is not for the farmer's interest is shown by the much lower prices obtained for corn and wheat now than before 1860; and that the wages of the laborers in protected manufactures are governed by something else than the tariff is shown by the very different wages paid in different States of the Union all under the same tariff.

Sharing the Profits, a pamphlet, by *Mary W. Calkins* (Ginn), is a very interesting

brief presentation of the subject of participation by employés in the profits of the business in which they are engaged. In the words of the preface, "It is an attempt to state, in the shortest and clearest terms, the theory of profit-sharing, to explain its methods, and to describe its results." A visit by the author to Paris and Guise in 1886 and to Geneva in 1887, in addition to study of the literature of the subject, has furnished the material for this essay. A brief statement of the arguments for profit-sharing is first given; this is followed by descriptions of the ways in which the practice is carried on by a number of concerns in France and neighboring countries; the relation of profit-sharing to pure co-operation, and the aid it may give to industrial reforms, are then pointed out, while in the last chapter certain ethical and economic objections to profit-sharing are answered.

The Union of the Societies for Ethical Culture began with April, 1888, the publication of a quarterly organ, called *The Ethical Record*. The subscription price is $1 a year, and the address of the publication committee is Post-office box 772, Philadelphia. The purpose of the "Record" is to present news of the ethical movement, and articles stating the spirit and aim of ethical culture. The third number, now before us, contains an address by S. B. Weston, Lecturer of the Philadelphia Society, on "The Final Aim of Life," in which Mr. Weston gives reasons for discarding the ancient Greek and the Christian views, and states, as the modern rationalistic idea, that the highest human purpose is "the development of life to its fullest perfection, physically, intellectually, morally." Another paper in the same number is part of an essay on "The Ethics of Insolvency," by Leo G. Rosenblatt. There are also "A Responsive Exercise," in use by the children's classes of the St. Louis Society, a selected poem, several pages of notes, and two pieces of music.

The Agnostic Annual for 1889, which is its sixth number, is edited by *Charles A. Watts* (W. Stewart, London, 6*d*.), and contains eight essays and three poems. The leading article is by Samuel Laing, and is a criticism of the position taken by Mr. Gladstone in his controversy with Colonel Ingersoll. Miss Constance Naden contributes a paper on "The Atrophy of Religion," and Mrs. E. Lynn Linton one on "Women and Agnosticism." The other essays are "Life: the Agnostic Definition," by Albert Simmons; "The Sublimity of Nature," by Charles Watts; "Science and its Detractors," by John Wilson; "Agnosticism among the Moors," by H. J. Hardwicke, M. D.; and "The Aloneness of Man," by G. M. McC.

Ruth, the Christian Scientist, by *John Chester*, M. D., D. D. (Carter & Karrick), is a novel with a purpose, which is to present various theories in regard to the effects of mind in the cure of disease. The doctrine of "Christian Science" is put into the mouth of one character, that of "Faith-Healing" into that of another, while materialism is represented by a young physician, and other characters fill in the background.

In *The Human Mystery in Hamlet* (Fords, Howard, and Hulbert), Mr. *Martin W. Cooke*, attempting "to say an unsaid word," maintains that this great tragedy, far from being a mere play-writer's happy thought, was wrought out, under an inspiration created by the achievements of earlier poets, with a definite end in view. This end was to show in the hero typical man, as he was moved under the force of the interior spiritual struggle of the passions for prevalence, under the domination of supernatural law. His arguments are well considered and forcibly presented, and are strengthened by illustrations from the "Electra" of Euripides and of Sophocles, and Vergil's "Æneid," illustrations which show great resemblance in motive and methods of treatment between Shakespeare and the classical poets.

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POPULAR MISCELLANY.

Faults of City Schools.—In his recent annual report on the public instruction of the State of New York, Superintendent Draper, after mentioning the first-class appliances for education employed in the cities and larger villages of the State, the systematic arrangements and competent superintendence found there, goes on to show the deficiencies of the city schools as follows: "Yet school-work in great cities is encompassed with innumerable perplexities. The conditions of life among the people are

widely different in all localities, but these differences are multiplied and intensified in great and thickly settled communities. All classes meet in public schools. The schools are large. The grading and classification of pupils are necessarily close and arbitrary. Individuality disappears, and there is small opportunity to bestow special care upon those personal traits of character and genius which in smaller and less mechanical schools are developed and cultivated so advantageously. The exactions and controversies of politics, unfortunately, encroach more upon the administration of school affairs in large places than in small ones. The people are farther removed from the schools, and they manifest less interest in them because they have less responsibility and power in managing and directing them. It not infrequently happens, also, that the law leaves the granting of appropriations for the extension or even the maintenance of a city school system with the Common Council, or some board which, in either case, was chosen without any reference to the schools, and which seems bound to offset its extravagances in other directions with severe parsimony toward the schools."

Sense of Direction in Insects.—Dr. H. C. McCook has observed a very accurate sense of direction displayed by the "horse-ant" (*Formica rufa*) of Great Britain, in laying out roads from the ant-hills to points in the surrounding woods. These roads or trails had in places a width of from two to four inches, and were distinctly marked upon the surface of the ground, which was stained a dark-brown or black, probably by the formic acid exuded from the insects, and the leaves and grass over which they ran were pressed down and smoothed by the constant passing of innumerable legs. From one large mound three roads ran beneath the tall undergrowth with remarkable directness to different oak-trees in which numerous aphides afforded a food-supply. Road No. 1 was about sixty-five feet in length, and ran in an almost perfectly straight line. No. 2 was about seventy feet long, and varied less than three inches from a direct line measuring from the tree to a point within two feet of the terminal tree. There the trail made a detour of about six inches. No. 3 was a little over one hundred feet in length. A short distance from the nest it touched an old stump which deflected the path at a slight angle, and further on it crossed a foot-path where the travel of the ants was much interfered with by passing human feet. In spite of the difficulties of the track, when the entire trail was staked off, its terminus was found to deviate less than three feet from a straight line drawn from the point of departure.

Australian Message-Sticks.—The descriptions by Mr. A. W. Howitt in the British Association represent a considerable variety as prevailing among the Australian tribes in the use of message-sticks. Some of them are elaborately marked, highly ornamented, and even brightly painted. No messenger known to be such is ever injured. The message-stick is made by the sender and kept by the recipient as a reminder of what he has to do. In one tribe the messenger, for friendly meetings, carries a man's kilt and a woman's apron hung on a reed; but for meetings for hostile purposes, the kilt is hung upon the point of a spear. With a tribe in Victoria, the principal man prepares a message-stick by making certain notches upon it with a knife. The man who is to carry it looks on, and thus learns the connection between the marks on the stick and the message. A notch is made at one end to indicate the sender, and probably notches also for those who join in sending the message. If all the people of a tribe are invited to attend a meeting, the stick is notched from end to end; if part only are invited, only a portion of the stick is notched; and if very few people are invited to meet or referred to in the verbal message, then a notch is made for each person as he is named to the messenger. The messenger carries the stick in a net-bag, and, on arriving at the camp to which he is sent, hands it to the head-man at some place apart from the others, saying, "So-and-so sends you this," and then gives his message, referring, as he does so, to the marks on the message-stick. As a rule, the notches on a message-stick are only reminders to the messenger of the message he is instructed to deliver, and are unintelligible to a man to whom they have not been explained; but certain notches appear to have a definite meaning, and to indicate

different classes. Mr. Howitt explained a method for indicating members, which fully disposes of the idea that the paucity of numerals in the language of the Australians arises from any inability to conceive of higher numbers than two, three, or four.

Modern Greek Personifications of the Sun.—According to Mr. J. Theodore Bent, the personifications of the sun among the peasants of modern Greece compare well with the legends of classical times. His beauty, power, and strength endow him with regal attributes, and he is supposed at night-time to seek his kingdom and live in a palace, where his mother tends upon him. We have also the sun's wife and the sun's daughter, and can compare the Macedonian legend of Heliojenni with the Homeric myths of Perse and her children, Circe and Aïetes. The sun, as messenger, may be compared with the words of the dying Ajax. The connection between sun-worship and that of the prophet Elias is very marked in modern Greece. Elias looks after rain, and is the Greek St. Swithin. Churches to him are always found on sites of ancient temples to Apollo. This idea of a union between St. Elias and a power over the elements is clearly shown in a manuscript from Lesbos. There is a connection between sun-worship and St. George, noticeable not only in the islands, but in Macedonia, where a curious swing ceremony is performed on St. George's day in honor of the sun's bride having been swung up to heaven on that day, and the *κάρα* fires are lit.

New Medicinal Plants.—Mrs. H. C. De S. Abbott has published an account of the enterprise of Mr. Thomas Christy, of London, in investigating and introducing the active principles of valuable medicinal plants. His operations are carried on at his estate in Sydenham and in the native countries of the plants, where he has agents employed in collecting and cultivating. One of the most important plants lately introduced is the *Strophanthus*, or arrow-poison of Africa, from which the powerful cardiac remedy strophantine is extracted. The plant is a creeper, topping the tallest trees, and bearing intensely bitter seed-pods. The oily pulp of the seeds, with which the natives smear their arrows, causes instant death, or stupor and foaming at the mouth, followed by death in the animals with whose blood it is mixed, while it does not appear to affect badly the flesh far from the wound. Among other new drugs are kerpod, good for chilblains; alvelos, efficient in skin-diseases; and the haya poison and sassy-bark, which produce anæsthesia of the cornea. Mrs. Abbott suggests that a rich field of research, to be cultivated with great advantage to the healing art, lies in the study of the uninvestigated plants of our own country. It is a field in which she is herself an earnest laborer.

Absence of Memory and Presence of Mind.—The sudden lapses of memory that occasionally attack persons of strong mind are frequently very surprising. Such lapses have occasionally been known to come upon public speakers without the audience seeming to have been aware that the speech had been marred. Thackeray relates that he once lost the thread of an after-dinner speech, and thought that he had made a fool of himself; but his mother, who was within hearing, was of the opposite opinion. The Rev. Henry Ware, of Boston, lost himself in the middle of a sermon and stopped abruptly. He was consoled after the service by hearing one member of the congregation remark to another that that was the best sermon Mr. Ware had ever preached. "That pause was sublime!" A French preacher, when a similar accident befell him, remarked, "Friends, I had forgot to say that a person much afflicted is recommended to your immediate prayers," and knelt down to pray. The afflicted person was himself, and his device was successful to the restoration of the thread of his discourse. A famous Irish actor was once called upon to sing his favorite song, "The Sprig of Shillalah," although it was not on the bills. He could not recollect the beginning, and appealed to the audience: "Ladies and gentlemen, I assure you that I have sung this song so often that I forget the first line!" The audience gave him the first line, and he went on with the song amid great applause. Father Taylor, the "sailor's preacher," when he once got confused, cried out: "Boys, I've lost my nominative case; but never mind, we're on the way to glory!"

British Gold-Mines.—The existence of gold in the British Islands, in quantities perhaps sufficient to pay for modest mining, seems to be established, thereby justifying Strabo's inclusion of the precious metals as among their products. In Wales, gold is found in Carmarthenshire and Merionethshire. At Gogafan, in the former county, are to be seen traces of extensive ancient (probably Roman) workings. At the Viga Cloga Mine, an average annual return of £2,500 was realized from 1860 to 1867, since when the yield has declined. In this mine the vein appears to have been more productive as the working was extended to a greater depth, contrary to what is generally believed about gold-mines. From the Cambrian Mine, 300 ounces, and from the Prince of Wales's Mine, from 300 to 400 ounces of gold have been extracted to the ton of ore. Gold-fields were worked in Ireland at the close of the last century, but operations were stopped in 1802 because the cost exceeded the profit. The attempt was renewed in 1840, but given up again on account of disputes. The principal mining sites were Ballin Valley, Ballintemple, and Killahurler. Gold-fields lie in Lanarkshire and Sutherlandshire in Scotland. They were worked with considerable profit in the days of the Jameses. The gold-field of southeast Sutherlandshire covers an area of thirty miles by twenty. The occurrence of gold in England is rather a matter of speculation; but it exists, and can be found and obtained. Mineral in north Cornwall has assayed eleven ounces to the ton. Mr. J. S. Farrer thinks that the reason no gold-mines are at present being worked in the United Kingdom may lie "far more in the state of the law than in that of the ground."

Children's Punishments.—Something can be said in favor of most of the forms of correction—the rod, strap, tasks, confinement, restriction to plain food, and many others—which have been more or less employed in the school and the family. But there is one which on no account should be employed. Boxing or pulling the ears, or, indeed, striking any part of the head, is most injudicious. Not every form of corporal punishment is so objectionable, but in applying it judgment should be employed. Thus, if a chastisement suitable for a robust child is given to a nervous or feeble one, it will be doubly felt, and will be out of proportion to the offense. Moral means of correction may be the most suitable for sensitive children, and, in the case of school tasks, may possess a certain educational value. There is, however, an important objection to such as imply confinement indoors, especially in cases where the culprit is some poorly nourished youngster to whom fresh air is a luxury, or in any case where the punishment is frequently repeated.

Searching for the Canals of Mars.—In his report at the American Association on the aspect of Mars, as observed at the National Observatory, Washington, Prof. A. Hall said that while observing satellites in April, attempts were made on several nights to see the canals, but without success, and then it was determined to make the trial in twilight, when the observers could see more in detail on the surface of the planet. But nothing like the regular canals drawn by European observers could be seen, although the usual reddish and dark spots and markings were visible nearly every night.

Japanese Mirrors.—The peculiar property of the Japanese "magic mirrors," some of which reflect the figures carved or stamped on their backs, was explained by Prof. Mendenhall, at the American Association. It has been known to the Japanese for a thousand years, but did not receive scientific attention till a few years ago, when a Frenchman studied out the reason of it. The mirrors are round metal disks with short handles covered with bamboo and curiously carved backs. The peculiar thing about them is that, when a ray of light is reflected from their surface upon a screen, instead of a mere blotch of light there appears a reflection of the figures upon the back of the metal. How this is accomplished Prof. Mendenhall explained on the principle of the divergence of rays of light from a convex surface. It has been discovered that the polished surfaces of some of the mirrors are slightly convex. In addition to this, the smooth surface is really irregular, though the irregularity can not be

noticed with the naked eye. When the mirror is cast, the cooling process has the effect of drawing it slightly out of shape, and the impress of the ornamentation on the back of the disk gives a practically indistinguishable variation in convexity on the smooth surface that is only noticed when the reflection is cast upon a screen. The mirrors are not made for the "magic" purpose. They are ordinary mirrors, whose magic properties are the result of chance, and not more than one in a thousand possesses them. The author conceives an application of the principle of these mirrors to the realization of the idea of seeing by telegraph, and suggests that, by the use of electro-magnets and selenium, a metal peculiarly sensitive to light-rays, it might be possible to transfer over hundreds or thousands of miles the reflection of letters, or even faces.

Effects of Tile-Draining.—The influence of tile-draining in flood and drought was thus presented by Prof. R. C. Kedzie, in a paper read at the American Association: "1. Surface ditching in conjunction with deforesting may increase floods and contribute to droughts. 2. Tile-draining may increase floods at the "break-up" in the spring, where the waters accumulated in the surface-soil by joint action of frost and soil capillarity during the winter and surface accumulation in form of snow are suddenly set free by a rapid thaw. 3. During the warm months tile-draining tends to mitigate floods by taking up the excessive rainfall and holding it in capillary form, keeping back the sudden flow that would pass over the surface of the soil if not absorbed by it and escape by flood; and also in mitigating summer drought by increasing the capacity of the soil to hold water in capillary form and draw upon the subsoil water-supply by reason of the increasing capillary power of such soil produced by tile-draining."

International Congress of Hydrology and Climatology.—The second triennial session of the International Congress of Hydrology and Climatology is to be held in Paris near the beginning of October, 1889. The President of the Committee on Organization is M. E. Renou, director of the Meteorological Observatory of the Parc de Saint-Maur. The committee has already arranged that the following questions, among others, shall be discussed: Conditions to be observed in the installation of a meteorological observatory; rules for weather-forecasting, and organization of weather-announcements at sanitary stations; climatology of different sanitary stations; comparison and classification of sanitary stations from the point of view of their climatological conditions; on the action of altitude and climates in affections of the lungs; programme of a course of instruction in climatology. Communications should be addressed to the secretary-general, M. Dr. de Rause, Paris, 53 Avenue Montaigne, from the 1st of October to the 1st of June, and at Neris (Allier), from the 1st of June to the 1st of October.

Mineral Evolution.—Dr. T. Sterry Hunt has asserted that "the transformation of the primitive igneous material of this earth's crust through the action of air and water, aided by internal heat, presents a mineralogical evolution not less regular, constant, and definite in its results than the evolution apparent in the organic kingdoms." Continuing the discussion of this subject in the British Association, he shows that the stability of silicated species under atmospheric influence is very variable, some being readily decomposed, and others very permanent; the indifference or chemical resistance, moreover, increasing with the hardness or mechanical resistance. "These two qualities vary for species of analogous constitution directly as their condensation; while, for species of similar condensation and hardness, the chemical indifference increases as alumina takes the place of the ordinary protoxide base, lime, magnesia, ferrous oxide, and alkalies—a fact readily explained by the comparative insolubility of alumina and aluminous silicates in atmospheric waters." Other changes less well known take place in silicates by the subterranean action of watery solutions, when a greater insolubility determines the formation of certain softer hydrated magnesian and aluminous species by epigenesis from harder and more condensed species. Mr. E. A. Ridsdale has spoken of the production and conservation of more stable species as described by Dr. Hunt as a gradual "selection of inert forms,"

and, further, as "a survival of the most inert." But, "as inertness consists in stability, and in fitness to resist alike the chemical and the mechanical agencies which destroy other species, it is evident that his phraseology is but another statement of the formula of 'the survival of the fittest.' The great principle of the change of the mineral matters which existed in former conditions of our planet, into other forms more stable under the altered conditions of later ages, is but an extension to the mineral kingdom of the laws already recognized in astronomical and biological development."

Training the Emotions.—It has been proposed to give some attention to regulating the development of the emotions, both in the young and in the adult public. Frances Power Cobbe, in the "Fortnightly Review," maintains that emotions come to persons by a sort of contagion far oftener than they spring up of themselves in the human breast. Any attempt to communicate our emotions by command, however, tends rather to produce the opposite feelings. In order to educate the emotions of others, we must employ this natural agency, contagion. In order to inspire a person with a given feeling, we must exhibit the feeling in ourselves. Parents, duly impressed with the importance of the subject, would carefully suppress, or at least conceal, such of their own emotions as they would regret to see caught up by their children. A teacher who has the respect and esteem of his pupils will affect their emotions for evil or good according as he betrays enthusiasm or aversion for selfish and sanguinary conquerors, according as he justifies or condemns assassins and anarchists, according as he represents science as seeking triumphs or truths, and according as he treats efforts for the elevation of mankind with levity or respect. The companions of the young have a great influence on the development of their emotions. As regards girls, their doubly emotional natures make it a matter of moral life and death that their companions should be pure and honorable-minded. Too little precaution is taken, especially in American public schools, against the herding of innocent children with others who have been familiar with vice. As regards the education of the emotions of the community, an excessively demoralizing influence was removed when the public was excluded from executions. Admirable machinery for the communication of noble emotions through the masses is furnished by majestic public functions and by funerals of distinguished men. Literature has an immense power to sway the emotions of all educated people. The stage is another great agency for training the emotions of the public, and, even when it produces only harmless merriment, its influence is wholesome and beneficent. Music and the beauty of nature and of art are also powerful levers of the higher emotions, which it becomes us to use for the benefit of our fellows whenever it is practicable to do so.

The Botanical Outlook.—In his address to the Biological Section of the British Association, Mr. W. T. Thiselton Dyer, while asserting the importance of botany, admitted that the outlook for systematic botany was at present somewhat discouraging. France, Germany, and Austria, he said, "no longer possess anything like a school on the subject, though they still supply able and distinguished workers. That these are, however, few, may be judged from the fact that it is difficult to fill the place of the lamented Eichler in the direction of the Botanic Garden and herbarium at Berlin. Outside of our own country Switzerland is the most important seat of general systematic study, to which three generations of De Candolles have devoted themselves. The most active centers of work at the moment are, however, to be found in our own country, in the United States, and in Russia. And the reason is, in each case, no doubt the same. The enormous area of the earth's surface over which each country holds sway brings to them a vast amount of material which peremptorily demands discussion. . . . The data of systematic botany, when properly discussed, lend themselves to very important generalizations. Perhaps those which are yielded by the study of geographical distribution are of the most general interest. The mantle of vegetation which covers the earth, if only we could rightly unravel its texture, would tell us a good deal about geological history. The study of geological distribution, rightly handled, affords an independent line of attack upon the

problem of the past distribution of land and sea. It would probably never afford sufficient data for a complete independent solution of the problem; but it must always be extremely useful as a check upon other methods. Here, however, we are embarrassed by the enormous amount of work which has yet to be accomplished; and, unfortunately, this is not of a kind which can be indefinitely postponed. The old terrestrial order is fast passing away before our eyes. Everywhere the primitive vegetation is disappearing as more and more of the earth's surface is brought into cultivation, or at any rate denuded of its forests. A good deal, however, has been done." Mr. Bentham and Sir Ferdinand Mueller have given a comprehensive flora of Australia, the first large area of the earth's surface of which the vegetation has been completely worked out. Sir Joseph Hooker is busy with the Indo-Malayan flora of the British dominions, and the Dutch botanists have described the Malayan flora proper. British botanists have begun to work the Chinese flora, and the French that of Yunnan. Prof. Bayley Balfour and Dr. Schweinfurth have studied the anomalous flora of Socotra. The flora of Africa has been partly studied, and of this, that of Madagascar is the most interesting. American botanists are still busy with their own flora, and the Russians are continually adding to our knowledge of the flora of Northern and Central Asia. The flora and fauna of Central America have been provided for by the munificence of two English men of science. The flora of Brazil is under slow examination and arrangement in Prof. Urban's "Flora Braziliensis." And the deep-sea exploring expeditions have made known the floras of remote islands.

An Enthusiast in Science.—Prof. W. Stanley Jevons wrote to his sister, from Melbourne, Australia, April 9, 1859: "This afternoon I called at the Melbourne Observatory upon the director, Prof. Neumayer, a rather new-comer. I was introduced to a little spare German, who received me with a tremendous bow, to which I was obliged to respond with interest. . . . With the greatest enthusiasm he at once commenced a complete round of his observatory, showing and discussing with me every instrument, meteorological, magnetic, and astronomical, of which, at least the two former kinds, he had a numerous and very varied collection, all in active use throughout the twenty-four hours. Then he showed me many of the numerical results, explaining the method of reducing them, and carefully taking my direction and name, that he might post me his published reports, and even promising immediately to set his assistants to work to copy out a few barometer readings which I required, and had made the ostensible purpose of my visit. . . . How delightful it is to meet this enthusiasm for true and highly useful things, when one passes whole years together among those who are enthusiastic and greedy only about gold! One would be willingly snubbed each day of the year by the rich and addle-headed, if only received so well as this by the truly best of their race."

Nascent Species of Plants.—Through the discussions of the floras of the western Pacific islands, collected by the Challenger Expedition, we have for the first time been enabled, says the Rev. W. T. Thiselton Dyer, to get some idea how a tropical island was furnished with plants, and to discriminate the littoral element, due to the action of oceanic currents, from the interior forest, almost wholly due to frugivorous birds. The recent examination of Christmas Island by the English Admiralty has shown the process of flora-making in another stage. The plants collected by Mr. Lister prove to be closely allied to those of Java. But the effect of isolation has begun to tell; and it is said by Prof. Oliver that the plants can not be for the most part exactly matched with their congeners from Java, but yet do not differ sufficiently to be specifically distinguished. "We have here, therefore, it appears to me, a manifest case of nascent species."

NOTES.

Prof. Frederick Tuckerman, M. D., of Amherst, has examined two specimens of tape-worm (*Tænia saginata*) of unusual length, sent him by Dr. John G. Stanton, of New London. The first specimen consisted of a long ribbon and several smaller pieces, measuring together over 7 metres, and comprising 711 joints. The head and the neck-joints were not obtained. The second worm

had 727 joints, and a length of a little more than 8 metres. Leuckart, the distinguished helminthologist, says, "According to Bremser and Diesing, the famous Viennese collection of helminths contains chains 20 to 24 feet long, very much longer, therefore, than the preserved specimens I have measured, which were at most only slightly above 14 feet." Hence, Prof. Tuckerman's two specimens, of 25 and 27½ feet are remarkable.

MR. JAMES CONSTANTINE PILLING has undertaken the compilation of bibliographies of various North American languages, which are now in course of publication by the Bureau of Ethnology. In preparation for this task he visited the principal public libraries of the United States, Canada, and northern Mexico, corresponded with librarians, missionaries, and other persons interested in the subject, and examined printed authorities. Every effort was made to take titles at first hand, with the result that a very large percentage of the books enrolled are described from the compiler's own sight. The bibliographies of the Eskimo and Siouan languages have been issued, and that of the Iroquois is to follow.

BATHING upon a full meal has long been considered dangerous. The physiological explanation of the peril is, that the blood in digestion tends toward the alimentary tract, leaving the brain proportionately anæmic, and the action of the heart and lungs impeded by a distended stomach. A cold immersion at this stage naturally inducing a tendency to syncope, and concentrating surface blood still more about the central organs, the heart finds the labor imposed upon it too great, and finally succumbs.

THE make of American salt, it is said, has more than doubled during the last ten years. Within the same period two new salt regions have enjoyed a rapid development. According to the "Saginaw Courier," 3,944,309 barrels of salt were made in Michigan in 1887, against 2,676,588 in 1880, and 561,288 barrels in 1869. More salt was made in Michigan in 1887 than had been made in all the time previous to 1869. A strong rival to the Onondaga district has been developed in the Wyoming region of western New York, where a most extensive salt-manufacture has grown up within the last five or six years.

THERE are still, according to the Rev. J. Batchelor, prophets and prophetesses among the Ainos, but they limit their powers to telling the cause of illness, prescribing medicine, using charms, and the like. The person prophesying is supposed to sleep or otherwise lose consciousness, and not to know what he is uttering. The burden of the prophecy sometimes comes out in jerks, but more often in a kind of sing-song monotone.

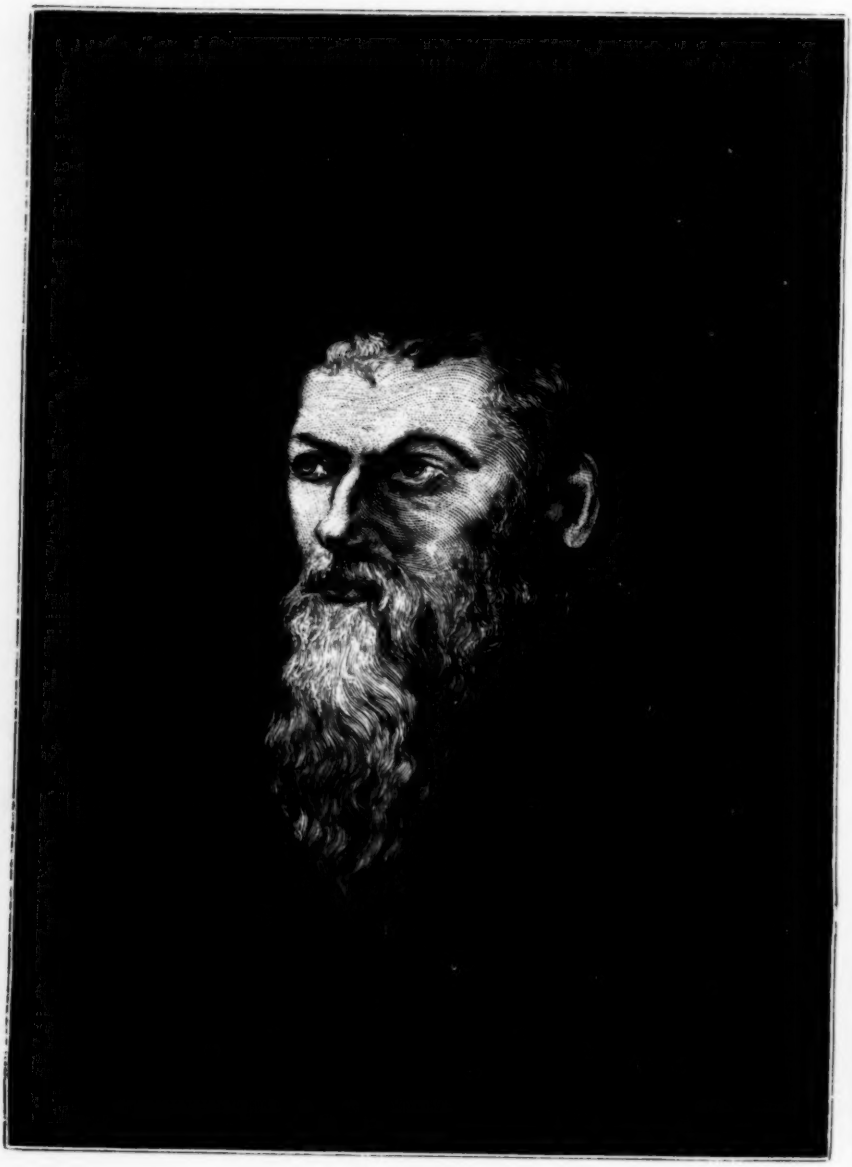
A DEXTEROUS management of the roller-shades of windows may be made to go a great way in promoting the coolness of rooms. Let the upper window-sash be lowered, and the inside blind or curtain placed outside and secured in position by passing its tassel-cord beneath the lower sash. Thus the window-glass is protected from the direct rays of the sun, and is at the same time cooled by the current of air that passes between the blind and window. An additional merit of the plan is that it promotes ventilation.

WHILE the value of kindness in discipline can hardly be overestimated, it must be admitted that suasion alone will not avail for every instance in which a pupil's will is idle or obstinate. Boys are well aware of this, and are apt to look for something more as constituting an authority worthy of obedience. Hence, it is argued by experts in training that it is unwise, and in the end unkind, always to spare the rod. But all striking at random must be condemned, and particularly such barbarity as boxing the head and ears. Nature has furnished a part, well cushioned, but sensitive enough, well adapted to the exercise of chastisement, upon which any punishment within reason will fall harmless.

ANNATTO thrives in Guadeloupe at heights of from 1,500 to 2,000 feet above the sea, while greater heights are progressively more unfavorable to it. The seeds are planted in holes prepared to receive them, or in nurseries, and the young plants require most careful attention during the first year; but afterward they grow fast and need but little care. A few pods may be gathered in one year after the plant has been transferred from the nurseries. Annatto bears twice a year, the spring blossoms always yielding the largest crop. As soon as the pods in the bunches begin to dry and open, the bunches are cut, packed in baskets, and carried to the shed prepared for the purpose. The picking of the pods is very tedious.

TWO French gentlemen are constructing a terrestrial globe for the exposition of 1889, on the scale of one millionth. It will be thirteen metres in diameter and forty metres in circumference, and a kilometre will be represented on it by a millimetre. Paris will occupy a space of about a square centimetre. It is believed that the contemplation of this object, whose size is a measurable fraction of that of the earth, will help, better than any other existing apparatus, to convey a realization of terrestrial magnitudes and distances.

AN attempt last year to cultivate the cotton-tree near Taganrog, on the Don, in European Russia, is said to have proved successful.



PIERRE BELON.